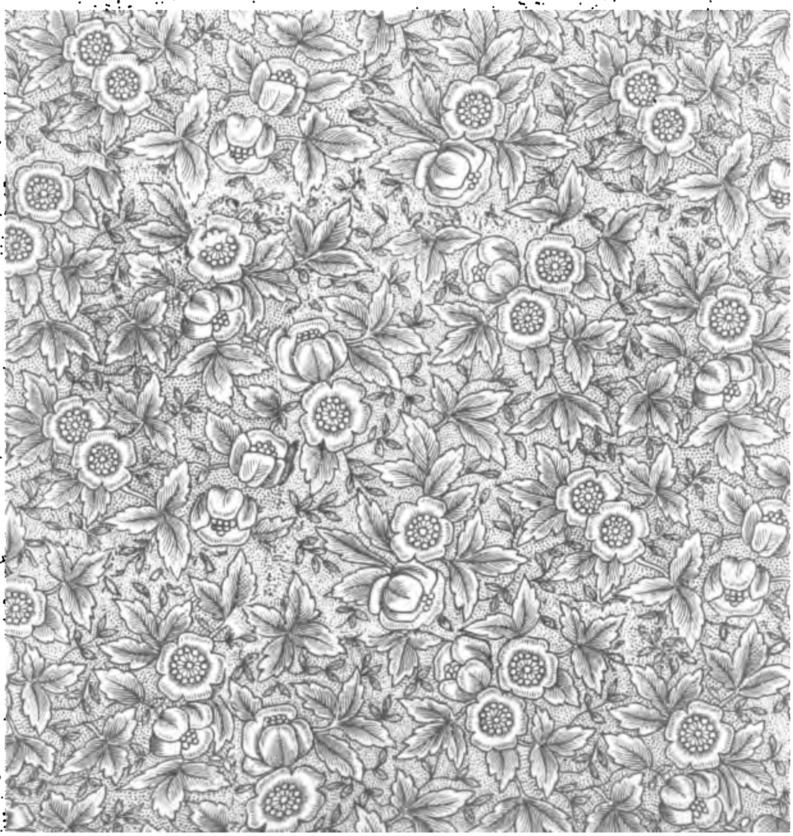

AMERICAN

3-vol

THE

AMERICAN GAS LIGHT ASSOCIATION.

REPORT OF PROCEEDINGS

OF THE

ANNUAL MEETING HELD AT NEW YORK, N. Y.

OCTOBER 17TH, 1883,

AND

ANNUAL MEETING HELD AT WASHINGTON, D. C.,

OCTOBER 15TH, 1884.

MAY, 1885.

PUBLISHED BY ORDER OF THE ASSOCIATION.

C. J. RUSSELL HUMPHREYS, Secretary.

PRESS OF A. M. CALLENDER & CO., 42 PINE STREET, NEW YORK.

The American Gas Light Association is indebted to the courtesy of the *American Gas Light Journal* for Stenographic Reports of the proceedings of the Association, gratuitously furnished for publication in this volume.

C. J. RUSSELL HUMPHREYS,
Secretary.

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ELEVENTH ANNUAL MEETING OF THE AMERICAN GAS LIGHT ASSOCIATION.

Held at Teutonia Hall. New York City, October 17 and 18, 1883.

Morning Session—October 17.

The Eleventh Annual Convention of the American Gas Light Association met at Teutonia Hall, New York City, Wednesday, October 17, 1883.

The President, Mr. Theobald Forstall, called the convention to order at 11 o'clock A. M.

The minutes of the last annual meeting having been published in the *American Gas Light Journal*, the reading was dispensed with, and they were approved as printed.

Applications for membership were received from the following gentlemen :

J. Gardner, Jr.,	Pittsburgh, Pa.
W. C. Butterworth,	Rockford, Ill.
C. F. Pritchard,	Lynn, Mass.
C. A. Willets, Jr.,	Flushing, N. Y.
G. W. Graeff, Jr.,	Philadelphia, Pa.
L. P. Lowe,	Philadelphia, Pa.
C. E. Judson,	Chicago, Ill.
C. L. Gerould,	Manchester, N. H.
W. G. Cartwright,	Hoboken, N. J.
J. S. Bush,	New York, N. Y.

F. K. Davis, . . .	Athol, Mass.
G. Cornell, . . .	Youngstown, Ohio.
H. H. Sheldon, . . .	Providence, R. I.
Chas. C. Fry, . .	Lynn, Mass.
D. T. Roots, . . .	Connersville, Ind,
George Rider, . .	Norwich, N. Y.
H. C. Graves, . . .	Dayton, Ohio.
P. W. Huntington, . .	Columbus, O.
J. T. Langford, . . .	Boston, Mass.
E. A. Potter, . . .	Ashland, Ohio.
J. H. Walker, . . .	Rochester, N. Y.
F. Thompson, . .	Charlestown, Mass.
A. Gleim, . . .	Plattsburgh, N. Y.
E. D. White, . . .	Brooklyn, N. Y.
S. V. Merrick, . . .	Philadelphia, Pa.
S. L. Jones, . . .	Philadelphia, Pa.
J. B. Smallwood, . .	Baltimore, Md.
C. H. Dickey, . .	Baltimore, Md.
P. Bauer, ...	Washington, D. C.
R. F. Hall. . . .	Troy, N. Y.
F. Seaverns, . . .	New York, N. Y.
O. B. Weber, . . .	New York, N. Y.
J. B. Crockett, Jr., . .	San Francisco, Cal.
James Slade, . . .	Yonkers, N. Y.
John Gribbel, . . .	New York, N. Y.
J. T. Lynn, . . .	Chattanooga, Tenn.
T. E. Connolly, . . .	Pittsburgh, Pa.
R. A. C. Smith, . .	New York, N. Y.
John Fullager, . . .	Cincinnati, Ohio.
C. E. Booth, . . .	New York, N. Y.
Jos. R. Thomas, . . .	Brooklyn, N. Y.
H. A. Atwood, . .	Plymouth, Mass.
Arthur T. Cooper.	Exeter, N H.

The applications were referred to Messrs. A. B. Slater, F. C. Sherman and A. C. Wood, as a committee to investigate and report upon the same, and the committee subsequently reported in favor of the election to membership of those named.

On motion of the Secretary, Messrs. Stiness and Slater were appointed tellers.

The Secretary was authorized to cast the ballot of the Association in favor of the election of the gentlemen named. The tellers reported that the ballot had been so cast, and the President declared that they were duly elected.

THE PRESIDENT—I am informed that a committee, consisting of General Charles Roome, President of the Manhattan Gas Light Company, and Mr. Thomas K. Lees, President of the New York Gas Light Company, are present; and I invite them to come forward and take seats upon the platform. I have pleasure in introducing them to the Association. (Applause.)

GEN. ROOME—I thank you, gentlemen, very sincerely for your reception. Mr. Lees and myself, as a committee representing the gas light companies of the city of New York, respectfully invite you, Mr. President, and you, gentlemen of the Association, to dine with them to-morrow evening at the Westminster Hotel. We desire to know who among you will accept, and who will not; and, for that purpose, would ask you to leave your names at the desk. We desire to have every member of the Association present, and we will entertain you with all the hospitality we are capable of showing. We want the table to be full; and we want you to be full before leaving it. (Applause.)

THE SECRETARY—I move the acceptance of the invitation so graciously tendered to us by the gas light companies of New York, with the thanks of the Association.

The motion was agreed to.

THE PRESIDENT—Gentlemen of the Committee: In the name of the American Gas Light Association, I accept and thank you for the invitation you have so courteously extended.

GEN. ROOME—All works of the gas companies of the city are open to your inspection; and we shall be very glad to see you at these places either individually or in a body, as may best suit your convenience. If you will let us know at the office of the Manhattan Company at what time you will visit the works,

the engineer or superintendent will be on hand to receive you, to welcome you, and to show you everything that there is to be seen, and to tell you all that we know about them ; and if you can teach us anything that we do not know, we shall be grateful to receive it.

MR. LEES—The establishment of the New York Gas Light Company is open to your inspection at any time, and if you will come there without any special invitation we shall be pleased to see you and bid you a most cordial welcome.

Upon the call of the roll the following members were reported as present :

Honorary Member.

Gen. Charles Roome, New York, N. Y.

Active Members.

Africa, J. S.,	Huntington, Pa.
Allen, A. L.,	Poughkeepsie, N. Y.
Allen, H. P.,	New York, N. Y.
Allyn, H. A.	Cambridge, Mass.
Archer, Benj. F.,	Camden, N. J.
Andrew, John,	Chelsea, Mass.
Avery, A. J.,	Dunkirk, N. Y.
Anderson, J.,	Cincinnati, Ohio.
Allmand, Charles S.	Norfolk, Va.
Averill, A. T.,	Cedar Rapids, Iowa.
Balmore, J.,	New York, N. Y.
Bates, J. W.,	Hoboken, N. J.
Battin, Isaac,	Albany, N. Y.
Benson, Fred. S.,	Brooklyn, N. Y.
Baxter, Wm. H.,	Petersburg, Va.
Beal, Wm. R.,	New York, N. Y.
Bill, George D.,	Malden, Mass.
Bradley, Wm. H.	New York, N. Y.
Butterworth, Thos.,	Rockford, Ill.
Baumgardner, J. H.,	Lancaster, Pa.
Baxter, R.,	Halifax, N. S.

Byrne, T. E. . . .	Brooklyn, N. Y.
Brown, Thos. R., . .	Philadelphia, Pa.
Burtis, P., T. . . .	Chicago, Ill.
Cabot, Geo. D., . .	Lawrence, Mass.
Cartwright, J., . . .	Fishkill-on-Hudson.
Cartwright, M., . .	Rochester, N. Y.
Cartwright, W., . . .	Oswego, N. Y.
Cornell, T. C., . .	Yonkers, N. Y.
Crafts, David W., . .	Northampton, Mass.
Cushing, O. E., . .	Lowell, Mass.
Cadwell, Wm. D., . .	Nashua, N. H.
Cressler, A D., . .	Fort Wayne, Ind.
Curley, T , . . .	Wilmington, Del.
Cabot, John, . .	Lawrence, Mass.
Collins, A. P., . . .	New Britain, Conn.
Copp, A. M., . .	Boston, Mass.
Coyle, P., . . .	Charlestown, Mass.
Cole, T. W., . . .	Altoona, Pa.
Coggshall, H. F., . .	Fitchburg, Mass.
Cowing, John H., . .	Buffalo, N. Y.
Condict, J. Eliot, . .	San Francisco, Cal.
Davis, F. J., . . .	Waltham, Mass.
Denniston, W. H., . .	Pittsburgh, Pa.
Diall, M. N., . .	Terre Haute, Ind.
Dickey, R. R., . . .	Dayton, Ohio.
Down, W. H., . .	New York, N. Y.
Dingee, F. A., . . .	Philadelphia, Pa.
Edwards, Geo. B , . .	New York, N. Y.
Floyd, Jas. R , . . .	New York, N. Y.
Forstall, Theobald, . .	Chicago, Ill.
Frost, W. H., . . .	Brooklyn, N. Y.
Fowler, John, . .	Philadelphia, Pa.
Flemming, D. D., . .	Jersey City, N. J.
Fodell, W. P., . .	Philadelphia, Pa.
Fogarty, Thos. B., . .	Brooklyn, N. Y.
Floyd, F. W., . .	New York, N. Y.
Floyd, H. E., . . .	New York, N Y.
Findley, J. H., . .	Ogdensburg, N. Y.

Fish, H. H.,	Utica, N. Y.
Fletcher, A. M.,	Indianapolis, Ind.
Gardner, Wm ,	Pittsburgh, Pa.
Gates, F. W.,	Hamilton, Ontario.
Gerould, L. P.,	Manchester, N. H.
Goodwin, W. W.,	Philadelphia, Pa.
Gridley, E. B.,	Bloomington, Ill.
Greenough, M. S.,	Boston, Mass.
Griffen, John, J.,	Philadelphia, Pa.
Geggie, David H.,	Quebec, Can.
Gerould, H. T.,	Cairo, Ill.
Hanford, L. C.,	Norwalk, Conn.
Harbison, J. P.,	Hartford Conn.,
Harrington, M.,	Niagara Falls, N. Y.
Helme, Wm ,	Philadelphia, Pa.
Hookey, G. S.,	Augusta, Ga.
Hopper, T. C.,	Philadelphia, Pa.
Humphreys, Wm.,	Dansville, N. Y.
Howard, L. J.,	St. Louis, Mo.
Humphreys, C. J. R.,	Bergen, Pt., N. J.
Hequembourg, C. E.,	Bradford, Pa.
Hyde, G. A.,	Cleveland, Ohio.
Hopper, Wm. H.,	Philadelphia, Pa.
Hallett, J. L.,	Springfield, Mass.
How, James,	Brooklyn, N. Y.
Isbell, Charles W.,	New York, N Y.
Jones, E. C.,	South Boston, Mass.
Kraft, Geo. W.,	Philadelphia, Pa.
Lindsley, E.,	Cleveland, Ohio.
Littlehales, T.,	Hamilton, Ontario.
Ludlam, Edwin,	Brooklyn, N. Y.
Learned, E. C.,	New Britain, Conn.
Leach, H. B ,	Taunton, Mass.
Learned, Waldo A.,	Newton, Mass.
Maurice, C. F.,	Sing Sing, N. Y.
McCauley, L. G.,	West Chester, Pa.
McElroy. J. H.,	Pittsburgh, Pa.
McIlhenny, John,	Philadelphia, Pa.

McMillin, E.,	Columbus, Ohio.
Monks, R. J.,	Boston Mass.
Murphy, H.,	Sing Sing, N. Y.
Morris, H. G.,	Philadelphia, Pa.
Merrifield, P. S.,	New York, N. Y.
Moses, G. W.,	Chelsea, Mass.
McDougal, J.,	Hornellsville, N. Y.
Neal, Geo. B.,	Charlestown, Mass.
Nettleton, Charles	New York, N. Y.
Nash, C. H.,	St. Joseph, Mo.
Nettleton, Charles H.,	Derby, Conn.
Norton, A. M.,	Nashua, N. H.
Odiorne, F. H.,	Boston, Mass.
Pearson, W. H.,	Toronto, Ontario.
Perry, A. D.,	Quincy, Mass.
Prichitt, S.,	Nashville, Tenn.
Pratt, J. C.,	Jamaica Plain, Mass.
Page, Geo. S.,	New York, N. Y.
Parrish, W.,	Seneca Falls, N. Y.
Perkins, J. D.,	New York, N. Y.
Raynor, C. H.,	Adrian, Mich.
Richardson, G.,	Wilmington, Del.
Rollins, J. H.,	Worcester, Mass.
Roots, F. M.,	Connersville, Ind.
Ramsdell, Geo. G.,	Vincennes, Ind.
Rowland, T. F.,	Greenpoint, N. Y.
Richardson, F. S.,	N. Adams Mass.
Robinson, Wm. L.,	Uniontown, Pa.
Ross, A. Q.,	Cincinnati, Ohio.
Roxbury, Jacob,	Alexandra, Va.
Sherman, F. C.,	New Haven, Conn.
Slater, A. B.,	Providence, R. I.
Sloane, T. O'Connor,	New York, N. Y.
Smith, Marcus,	Wilkesbarre, Pa.
Stanley, I. N.,	Brooklyn, N. Y.
Spear, J. Q. A.,	Dorchester, Mass.
Starr, J. M.,	Richmond, Ind.
Stedman, Wm. A.,	Newport. R. I.

Stiness, S. G.	Pawtucket, R. I.
Smedberg, J. K.	Lancaster, Pa.
Stein, E.	Philadelphia, Pa.
Sprague, Chas. H.	Boston, Mass.
Turner, Thos.	Charleston, S. C.
Tufts, N.	Boston, Mass.
Vanderpoel, Eugene	Newark, N. J.
Van Benschoten, C. C.	New Rochelle, N. Y.
Warmington, Geo. H.	Cleveland, Ohio
White, Wm. H.	New York, N. Y.
Wood, A. C.	Syracuse, N. Y.
Wood, G.	New Bedford, Mass.
Weber, Adam	New York, N. Y.
Whitney, S. W.	Albany, N. Y.
Wood, Edward L.	Lewiston, Me.
Zollikoffer, Oscar	New York, N. Y.

PRESIDENT'S ADDRESS.

The President read the following address :

Gentlemen of the American Gas Light Association :

In assuming the honor of presiding over your deliberations, I am quite conscious of my inability to acquit myself in a manner worthy of my predecessors in this chair ; but I am encouraged by the certainty of your indulgence, and consoled by the hope that my sins of omission or commission may serve some good purpose in the mysterious dispensation of Providence.

We have returned to the metropolis after an interval of five years which has been the most critical period in the history of the gas industry. For during that short space the voltaic arc, leaping beyond the bounds of the student's laboratory, has blazed out upon our astonished vision in every city and town throughout the land, to dazzle us with its splendor, and to wrest the future from us. All the resources of modern science and skill and capital have been concentrated upon its development, with a result wonderful to us even who were not carried away by the prophecies of our enemies or the fears of our

friends. For a short time the supremacy of gas seemed to tremble in the balance. But as the months rolled by, the soft and mellow radiance still shone serenely beside the flickering glare, and we can to-day congratulate ourselves that out of the nettle danger we have plucked the flower safety, for the dreaded rival has already become the most active stimulant to the use of gas, and the light of the future is still our own.

While the price of our illuminant steadily declines, the equally steady rise in the cost of petroleum hastens the day when we shall furnish fuel and light to the cottage as well as to the mansion. I trust that our meeting will be fruitful in results tending toward this end ; that each one of you has come here, to-day, prepared to add his contribution, however slight, to its proceedings ; and that when we separate we shall each take back to our respective fields of duty an increased ability to cheapen the cost and improve the quality of our gas.

We shall miss the inspiriting presence of some of our most earnest fellow-workers, who have been removed from this life since our last meeting. Among these William H. Price, President of the Cleveland Gas Light Company, and Past President of this Association, and G. Warren Dresser, Editor of the *American Gas Light Journal* will leave a void in our ranks which cannot be filled. We have lost in them, not only active and earnest members of our brotherhood, identified with the progress of the gas industry, but friends of sterling worth. Their pregnant speech gave point to our discussions, and their genial manners brightened our social intercourse. But this is not the time to dwell upon their merits and mourn our loss. To other friends who knew and loved them well this task has been intrusted, and in the archives of our Association a just memorial of their life and services will be written and preserved.

Although no discovery or new invention has appeared during the past year in any department of gas manufacture, much has been done to bring the principal gas works throughout the country abreast of the present state of our knowledge both chemical and mechanical. Old retort benches are disappearing to be replaced by larger settings, heated by generated furnaces. Condensation is carried on more thoroughly and more gradu-

ally to prevent the deposition of the light vapors so valuable as illuminants. Improved scrubbers removing all the ammonia, are daily superseding the old and inefficient washers and coke scrubbers.

The burners of Sugg and Bray and Siemens are to be seen in every city educating the gas consumer as to the possibilities of gas lighting, while the gas engine steadily gains ground as the most economical and convenient motor for moderate power.

For such progress as may thus be noted, we should indeed congratulate ourselves; but to all who realize the almost infinite possibilities of development in the uses of gas still dormant in our cities, our annual advance seems all too slow and unsatisfactory. Except under the immediate stress of competition, our companies are too half-hearted in adopting the means necessary to secure the largest sale of gas. In addition to the adoption and skillful application of the best methods of manufacture and the most perfect apparatus, every system of publicity used by other manufacturers and merchants to increase their business, even—to the solicitation of custom—should be resorted to. The example of the electric light companies in this respect is worthy of imitation. Excessive deposits, charges for service pipes and meter connections, and all unnecessary hindrances should be abolished. The path from the oil lamp to the gas burner must be made for every applicant as straight and smooth as the "*decensus averni*."

Then with the price of 16-candle gas brought down in our large cities to $1 per thousand, the ill-smelling, troublesome, dangerous oil lamps and stoves will be driven out of every house.

For such a consummation, devoutedly to be wished and worked for, we can all within the limits of our influence do much more than we have hitherto done, especially by combined and systematic efforts to secure the co-operation of legislatures and councils. The first step in this co-operation would be an immediate cessation of grants to competing companies. It will doubtless seem idle to expect an intelligent and honest consideration of the gas question on the part of city

legislators, but I do not despair of an ultimate change of mind even in that quarter. As soon as the small traders and saloon keepers, whose votes elect the councilmen, become impressed with the fact that every ordinance passed to establish a new gas company puts money in the pockets of a few dishonest aldermen but depletes their own by ultimately and permanently increasing the cost of their light and their taxes for street lamps, their influence will become more potent than the blandishments of patent promoters.

Up to the present time this influence has been exerted in favor of new companies, through ignorance of the consequences. It is not strange, therefore, that municipal bodies, even when honestly intentioned have, with very few exceptions, utterly failed to comprehend the conditions which underlie the question of cheap gas. Urged on by the cry of competition from the press, the unreflecting public and the owners of patents have, in many cities actually made cheap gas impossible, by encouraging an investment of capital in gas works and mains far in excess of the present needs of the consumer; overlooking the fact that an income upon this expenditure must be earned by increasing the selling price of gas. Nor is the evil confined to those cities in which competition actually obtains a foothold. All gas companies established without guarantees, and subject to the whim of councils and the cupidity of rings, appreciate the uncertainty of their position, and prepare for the inevitable struggle by maintaining a higher price to increase their profits and reap the fullest harvest while the field is all their own.

The desire to make the most of a precarious situation is a trait of human nature not confined to the directors of gas companies. And thus, uncertainty of tenure has been, and is to-day, an active cause of dear gas and excessive dividends, in anticipation of probable competition. Nor is there a single permanent advantage which can be offered in good faith to municipal corporations or individual consumers by a competing gas company which an established company would not willingly concede in exchange for permanency of tenure. Moderate dividends, well secured over a term of years, are more attractive to investors than large but uncertain profits, which may

disappear at any moment by the unexpected votes of a few aldermen.

Were this a new question, and one peculiar to the United States, it could be easily proved, *a priori*, from the very nature of the business, that the ordinary law of competition does not apply to the supply of gas. But we have the more convincing evidence of actual experience in England, to show both the evils of unrestricted competition and the great benefits of regulated exclusive rights. Upon the free trade principle, thirteen competing companies, at one time, and for many years, fought in the streets of London. The war very soon became a struggle for bare existence, in which profits were out of the question. The author of "King's Treatise" gives a very graphic picture of the situation during the height of the competition in 1845. Some of the companies were brought to the verge of ruin, being saved only by the extraordinary growth of the metropolis and the increasing demand for the new illuminant. The Equitable Company offered its whole property for sale at £30.000—and the £50 shares of the London Company were sold for £2 5s. as late as 1852. For ten years no dividends were paid, except by the South Metropolitan Company, which divided 1½ per cent. in 1836, 2½ per cent. in 1837 and 4 per cent. in 1839. Finally, as a necessity to self-preservation, the district system was adopted, the price of gas was raised, and each company held the exclusive right of supply in its district.

To protect the interest of consumers the Parliament intervened. The Metropolis Gas Act of 1860 "confirmed the wisdom of the principle of limiting each company to its own particular district; but this monopoly was regulated by the introduction of clauses fixing the maximum price for 12-candle gas at 4s. 6d. per 1,000 feet, with power to the Home Secretary to grant an increase up to 5s. 6d. in case the necessity should arise." The supply of gas was made obligatory, and a standard of purity and illuminating power was fixed. "The dividends were limited to 10 per cent. per annum, and all surplus profits, after forming a small reserve fund, were to be applied in reducing the price of gas."

From the passage of this act an era of uninterrupted prosperity began for all the companies. By the steady increase in the demand for gas, and the reduction of losses and expenses due to competition, the 10 per cent. dividend was easily earned, and the reserve fund filled. Successive slight reductions in price were made by some of the companies, but there was still lacking in the law a sufficient incentive to reduce the cost of manufacture in behalf of consumers. This was at last supplied by the admirable system of the sliding scale, proposed by George Livesey, Secretary and Engineer of the South Metropolitan company, which was incorporated in 1876 by Parliament, in the bills of the Chartered and South Metropolitan Companies. It has since become the vital principal of English gas legislation. Under this plan, an initial price is fixed for each company, after a thorough investigation of all its circumstances, which shall enable it "by good management" to earn 10 per cent. on its capital, and keep up its reserve. If, however, by better management, it can reduce the price to consumers below the initial price, it is allowed to increase its dividends in a certain fixed ratio above the 10 per cent.; thus dividing with the consumer the profits of economy.

This simple solution of the much vexed question was vehemently opposed by the gas companies, and Mr. Livesey was at first looked upon almost as a traitor to the cause. But the happy results which have followed its adoption have changed the current of opinion. Mr. Livesey is now justly considered the saviour of the metropolitan gas interests, which would doubtless have been seriously compromised, under the pressure for cheaper gas, by the transfer of the public supply into the hands of the municipal authorities. Another direct result of the law has been the consolidation of the separate companies. Instead of thirteen, there are now two companies, only, supplying the whole metropolis, and the price has been by them reduced to 3s. 2d. and 2s. 9d., respectively, with an increase of dividends to 11 and 12 per cent. The latest accounts justify the belief that before many months these two companies will have become consolidated into one single corporation, with a capital of $50,000,000, and an annual sale of

18,000 million cubic feet of gas, at the price of 70 cents per 1,000.

Is it not a sad commentary on our boasted enlightenment that all this costly and fruitful experience has been wasted upon us; that while, step by step the English legislature has been working toward a true solution, harmonizing all interests, our law makers are still floundering in ignorance, imposing upon the public all the annoyances and losses from which our English cousins have safely emerged?

Let us imagine for a moment what might have been the situation in New York to-day if its municipal authorities had learned the lesson taught them by the city of London and applied it here. Instead of six companies, with a combined capital in stocks and bonds of $22,000,000, and a seventh preparing to enter the field, the four old companies, probably consolidated into one, would be supplying the whole of Manhattan Island, with a capital not exceeding $15,000,000. The annual loss to consumers on the present excess of capital invested alone at 7 per cent. interest, is $490,000, in addition to the increased cost of gas due to the maintenance of six separate staffs of officers in every department, with double, treble, and, in some streets, quadruple lines of mains and services and drips. This single consolidated company, secure in its tenure, limited in its capital, strictly regulated in regard to the purity and quality of its gas, and increasing its profits only as it reduced its price to the consumer, would be to-day selling 16-candle gas at $1 per 1,000, or proportionately for higher quality, and earning not less that 10 per cent. dividends. Making all due allowance for the high candle power of the gas of the present companies, the saving to the people of New York would be fully $5,000,000 per annum.

This may seem an exaggeration; but it can be proved without difficulty that these figures are rather below than above the truth.

From the latest official reports (July, 1883), we find that the combined paid-up capital of the Chartered and South Metropolitan Companies is, in round numbers, $47,000,000, and their annual sale of gas 17,000,000,000 cubic feet, or at the rate of

$2.765 of capital per thousand cubic feet sold. The combined average price received for gas and meter rents by both companies is 77 cents per thousand cubic feet. The net profit is, in round figures, $5,750,000, or a trifle more than 12 per cent. on the entire capital. Nor must it be forgotten that the capital of the London companies represents considerably more than the actual cost, or present structural value of their plant. The excess of capital expended, in the days of competition, in miles upon miles of unnecessary mains and services, in the extravagant Parliamentary charges incident to the establishment of every new company, in the great cost of developing a new industry in which rapid improvement caused frequent renewals of apparatus—this dead weight is still represented in a greater or less degree in the present income-earning capital, and must be taken into account in comparing the situation in London with that in New York.

Assuming that the present gas consumption of this city is 5,000 million cubic feet per annum, and allowing a capital investment of $3 per 1,000 cubic feet sold, one single company would have to earn dividends upon $15,000,000. What profits could it make from gas on the basis of $1 per 1,000 for 16-candles?

For the first half year of 1883 the cost of gas delivered to consumers by the South Metropolitan Company was 39.65 cents, and by the Chartered Company, 44.90 cents; the average being 43 cents on the whole quantity sold by both companies. Of the items making up this cost, two only are lower than the corresponding items in New York—viz., coal and labor. The net cost of coal, less residuals, was 9.62 cents per 1,000 cubic feet sold for South Metropolitan, and 13.33 for the Chartered Company. In New York the greater price of coal and the lower value of residuals would bring the net cost of coal up to 25 cents per 1,000. The cost of labor and superintendence at the works of the London companies is 9.11 cents and 8.38 cents respectively. This in New York would be amply covered by 15 cents per 1,000.

To a single company, then, supplying the whole island, the cost of 16-candle gas would stand about as follows:

Coal—net cost per 1,000 sold, lest residuals . .	.25
Labor and superintendence per 1,000 sold .	.15
Retorts, purifying material, etc.	.05
Cost in holder	.45
Repairs, distribution, taxes and general expenses	.20
Total cost delivered per 1.000 sold . .	.65

The profit would be 35 cents per 1,000 cubic feet, or $1,750,000 per annum—say 11.66 per cent. on the assumed capital. Ten per cent. dividends could be paid, reserving the surplus for a contingent fund. An addition of 25 cents per 1,000 to the selling price would cover the increased stock of 25-candle gas, and would still leave a margin of gain to consumers of $1 per 1,000, at the present price of $2.25. It cannot be doubted, moreover, that the present consumption of gas would soon be doubled at the lower price, still further reducing the cost of distribution.

These figures are based upon actual expenses in other cities not more favorably situated than New York, which latter I have taken as a type of all the larger cities of the Union, because the eventual loss to consumers of gas from the results of competition is to-day more clearly shown here than elsewhere. To enable six originally competing companies to live profitably, the citizens of New York must be taxed $5,000,000 per annum through the ignorance or connivance of their legislators, and their own culpable apathy.

I am prepared to hear the advocates of patented processes contend that established companies, being wedded to coal gas, would not adopt new methods or improved apparatus when once secure against competition. But this objection disappears under the changed circumstances; for if the dividends of a company can be increased only in proportion as it reduces the price of gas, the greatest inducement is ever present to the adoption of every invention which will improve the quality and reduce the cost. On the other hand, new processes would be compelled to pass the ordeal of thorough and continued practical tests, in which every item of cost would be accurately

ascertained by the gas manager. Under these conditions the survivals would probably be few; but the loss of the patentee would be the great gain of the gas consumer, who now pays the cost of every crude method of combination by which anthracite, water, and petroleum are expected to supersede bituminous coal in gas works.

Another great advantage which would accompany the adoption of English gas legislation would be the publication of the accounts of the companies, in such form as to exhibit the actual cost and profits of the business. There was a time when secrecy was apparently of benefit to gas companies. Excessive dividends, leading to excessive dilutions of capital, seemed to require concealment. But the veil was always semi-transparent. The market value of the shares was an unerring index to the large profits; and these were even exaggerated by the public. Indeed, competition has been directly and strongly encouraged by the hope of participating in the bonanza which has appeared more valuable from the very efforts made to conceal it. Moreover, the publication of accounts would establish beyond controversy the relative cost of coal gas and water gas, candle for candle. It would create a spirit of emulation, as it has done in England, between the officers of the various companies, all vieing to make good records; and the standard of competency would thus be raised in all the companies.

The knowledge by the consumer that the affairs of his gas company were as well known to him as those of his bank, would remove much of the prejudice and suspicion which he now harbors against it; and he would soon acquire the conviction that the supply of gas is a legitimate and Christian business, not necessarily destructive of integrity.

The system of secret accounts is justified by its advocates on the ground that the business of a gas company is a matter with which the public has no more concern than it has with the management of a mill, a factory, or any other private corporation. But the simple fact that, although organized for private gain, a gas company is really a corporation established for a public purpose, with rights and privileges enjoyed by no

private industry, places it in a relation to the community very different from that occupied by other business corporations.

The right to enter private dwellings, and to break up and occupy the public streets without compensation, entails the correlative duty not to abuse these privileges by making them the source of undue profits to individuals. The public has therefore the right to know what advantage is taken of its concessions.

I am daily more impressed with the necessity that this whole question be placed upon a proper basis without delay. The recent organization of companies with the express purpose of compelling the adoption of patented processes in every town and city in the Union, whose agents place before the established companies the alternative either of paying blackmail or of submitting to competition, makes prompt action imperative. The consnmer, who will be eventually the victim of the situation, cannot take the initiative in bringing about a solution, because he does not understand the question. The issue must be raised in his behalf by the gas companies themselves ; not simply in each town, as attacked in the desultory manner which has hitherto failed ; but by combined and systematic action, in which the influence of all will be exerted at every threatened point—not only to prevent the establishment of new competing companies, but to enlighten the legislatures, the councils, and the people, in order to bring about a final adjustment of interests between the cities, the consumers, and the companies in the spirit of the English legislation, embodying these principles—viz. :

1. Exclusive and obligatory supply secured to established companies.

2. Initial price sufficient to earn 10 per cent. upon structural value of plant, with sliding scale of dividends.

3. Purity and candle power regulated, and efficiently tested, with penalties for infractions.

4. Annual publication of accounts.

It may, I repeat, seem Utopian folly to hope that any such

settlement of the gas question can be accomplished in this country. It certainly cannot be reached without effort; and the effort must be made by the companies. The favorable result of an intelligent presentation of facts in the case of Boston should encourage us to trust in the common sense of our fellow citizens after the truth has been fairly driven home to their minds and pockets, that from one well managed and regulated company they will obtain permanently better and cheaper gas than from a multitude of irresponsible and uncontrolled corporations.

In cities where capital has been expended in water gas works and double lines of mains and services, these could be utilized with advantage, after an adjustment of interests, for the supply of purely heating gas. The use of illuminating gas for heating and motive purposes has rapidly increased of late years, in spite of its comparatively high price; but the limit of its adoption with economy to household and manufacturing needs will be reached, even at the lower prices of the near future, long before we shall have secured possession of the whole field destined to be eventually occupied by the gaseous fuel.

It may be doubted whether, at the present day, the cost of special plant to make and distribute a purely heating gas would be remunerative. My own opinion is that in cities of a population of 100,000 and more, it would be profitable, even now, for established gas companies to lay special mains for this purpose in their denser districts. A non-illuminating, unpurified water gas, produced from cheaper, inferior coals, could be put into holders for 15 cents per 1,000, distributed for 10 cents more, and sold, at a fair profit, at 40 cents per 1,000. Such gas, possessing one-half the calorific power of ordinary coal gas, would, at that price, be equivalent in cost to the consumer to coal gas at 80 cents per 1,000. It would be immediately preferred to solid fuel for a great variety of uses for which illuminating gas is too expensive.

Although I am sensible that I have done but scant justice to my theme, and have failed to present the subject as effectively as its importance requires, I shall not take up any more of your

time to-day. I thank you for the kind attention with which you have listened to me, and bespeak the same favor for the gentlemen who have prepared papers for us. These, judging from their titles, cannot fail to be both instructive and interesting.

On motion of Mr. Sherman the thanks of the Association were tendered to the President for his very interesting and instructive address.

On motion of Mr. Slater it was ordered that 1,000 copies of the President's address be printed and distributed among the members of the Association.

REPORT OF EXECUTIVE COMMITTEE.

The following report of the Executive Committee was read by the Secretary:

To The American Gas Light Association:

GENTLEMEN: Your Executive Committee report the following acts and recommendations for your approval:

The hours for holding the sessions during present meeting will be—Wednesday, meet at 10 A. M., recess from 12.30 to 2, adjourn at 6 P. M. Thursday same hours to be observed.

Volume V. of Proceedings of the Association having been printed, and a single copy sent to each member, we now recommend that the Secretary be instructed to send an additional copy to each member, in accordance with the usual custom.

In matter of members more than three years in arrears for dues, we recommend that their names be dropped from the roll of membership, if at the close of this meeting their dues remain unpaid.

It is recommended that the salary of the Secretary and Treasurer be placed at $500 per annum and his actual expenses in attending meetings of the Association.

Papers by the following members are approved of and will be read during the sessions:

J. C. Pratt, on "The Successful Gas Manager;" George Cornell, on "Proper Location of Meters in Buildings;" T. B. Fogarty, on "New Process of Making Water Gas;" T. O'Connor Sloane, on "Self-Registering Photometers;" W. W. Goodwin, on "Proper Combustion of Gas;" W. A. Stedman, on "New Furnaces."

Respectfully submitted for the committee.

WILLIAM HENRY WHITE, *Secretary.*

On motion of Mr. Vanderpool the report was accepted, and its recommendations adopted.

TREASURER'S REPORT.

The Treasurer read the following report:

Receipts.

To cash balance, Oct. 1, 1872,	$1,350 23	
Initiation fees,	290 00	
Dues, year 1879,	5 00	
" " 1880,	25 00	
" " 1881,	40 00	
" " 1882,	170 00	
" " 1883,	600 00	
" " 1884 (in advance),	60 00	
Sales of books,	3 00	
Interest on Funds of the Association,	53 88	
		$2,597 11

Disbursements.

Salary of Secretary and Treasurer,	$300 00	
Publishing Vol. V. of Proceedings,	690 24	
Printing and Stationery,	46 13	
Expenses of Pittsburg Meeting,	47 60	
Postage Stamps,	48 70	
Sundries,	15 80	
Balance in Savings Bank,	1,388 44	
On hand, petty cash,	60 20	
		$2,597 11

There is due from members for annual assessments, including 1884, ... $1,955 00

Respectfully submitted,

WM. HENRY WHITE, *Treasurer.*

Examined and found correct.

A. B. SLATER,
GEO. S. HOOKEY, *Finance Committee.*
JOHN ANDREW,

Mr. Slater reported that the Finance Committee had examined the accounts of the Treasurer, and found the same to be correct in every particular.

On motion, the Treasurer's report was accepted and approved.

MEMBERSHIP OF THE ASSOCIATION, DEATHS, ETC.

The Secretary reported as follows concerning the membership of the Association : Total number of active members, 235 ; total number of honorary members, 6. The following deaths were reported: William H. Price, Cleveland, Ohio ; G. Warren Dresser, (honorary member), New York City; A. W. Richardson, North Adams, Mass. ; M. W. Caughey, Erie, Pa. ; James D. Merriman, Pictou, Nova Scotia ; Edwin Keith, Taunton, Mass.

REPORT OF COMMITTEE ON PRESIDENT'S ADDRESS.

THE PRESIDENT—At the last meeting of the Association a committee, consisting of Messrs. William H. Price, A. C. Wood, and Eugene Vanderpool, was appointed to consider the subjects treated of in the address of President Hickenlooper, and that committee was to report at this meeting. Is that committee now ready to report?

Mr. Vanderpool read the following report :

To the Members of the American Gas Light Association :

GENTLEMEN : The committee appointed by you to consider certain suggestions and recommendations contained in the

annual address read before you by General A. Hickenlooper, President, on October 18, 1882, would respectfully report :

1. That, much to their sorrow and loss, the chairman of your committee, William H. Price, Esq., of Cleveland, Ohio, died before a meeting was held, and consequently his advice, experience and judgment have not been at our command, and our report must be, in consequence, less full and complete than it otherwise would have been.

2. Your committee inferred, from the discussion had at the meeting in Pittsburg, Pa., that the most important matter for them to consider was whether the existing gas interests of the country could be protected, strengthened, advanced, and improved by means of a closer association than is now maintained between them ; whether such an association would be feasible, and that some plan be suggested whereby such an organization might be attempted.

3. It appears to your committee that there are many most important problems, some of them possibly vital to the interests we represent, concerning the manufacture, distribution and consumption of gas, that require for their solution, men of the highest intelligence, education and experience. Moreover, these men must have all the financial support that is needed to carry out their views. In making any complicated or costly experiments, there should be no failure to determine the facts for the want of means, so that when certain results are arrived at it will be known they are reliable. It is certain the company does not exist with us that could or should be so enterprising and self-sacrificing as to determine these questions for itself and others. Even if it did, the results obtained would not carry with them the same stamp of reliability and authority as would be obtained from experiments ordered by a number of companies and carried out under the direction or advice of men of a large and varied experience. Not only so, but by means of concentrated action questions might be determined in a year that are now a generation old, have been half solved time and again, and seem to come up for discussion at all the meetings of gas associations the world over.

As an illustration—whose dictum will be universally accepted as to the exact temperature required to carbonize a standard coal to the best advantage? Or with what expenditure of coke should it be done, or by means of what generator furnace and recuperator?

It would be easy, but not here necessary, to multiply these interrogations. It is quite clear that the facts determined by one experiment carried out in the best manner and under the most favorable conditions, would be much more valuable and reliable, and it would cost far less than if the same had been arrived at by tests made in a slipshod manner by half the companies in the country. Yet the latter conditions, to a great extent, obtain to-day. We think the present price of gas would be much less in not a few places if the capital accounts of many companies had not been increased to include moneys foolishly expended or wasted in unwise experimentation.

These presentments apply not only to moneys wasted in the manufacture, but also to that expended in the construction of too costly or illy-designed plant.

4. An organization of the character suggested could do much toward deciding questions outside the technical departments of our industry. The public is interested in some of these questions in an eminent degree, and, fully understanding both sides, could not be misled, as is now the case, by speculators or agitators interested in exciting prejudices and making the false appear true. As an important illustration, the problem of so-called competition in the supply of gas may be noted. The intelligent searcher after truth, however biased, quickly learns that competition in the supply of gas is practically impossible. History teaches him that its permission under any and all conditions surely entails trouble, vexation, and cost to the public, and that it is an evil to the producer, consumer, and every one connected directly or indirectly with the development of the gas industry. The speculator or agitator alone is benefited, and his ill-gotten gains, "his unthrifty dispensation of the public resources," are represented by a burden on the community in which he operated that time cannot lessen.

5. It may be asked how could an organization like that suggested effect this?

A properly-constituted organization would have an immense moral and material strength and influence that the single corporation does not, except in isolated instances, possess. By means of this influence, in the words of General Hickenlooper, "they could be instrumental in defeating unjust and oppressive legislation, or in securing the enactment of general laws which, while fully protecting the interests of the consumer, will at the same time define the rights and obligations of the manufacturers with an exactness that can afford no reasonable grounds for dispute."

It appears to your committee that by some such means legislation analogous to laws in force in England may be attained. Laws concerning the supply of gas sooner or later will be enacted here with or without the consent of the gas companies. They may be oppressive and unjust, or reasonable and fair. Their character will depend upon the attention given the subject by those most interested, and upon the influence on the public mind of a full, free, and fair statement of our position.

The English Gas Works Clauses Act of 1847, and its amendment in 1871, provides in addition to much else concerning the manufacture and distribution of gas, for the quality and price of gas. The dividends to be paid on capital raised are limited to 10 per cent.; and a reserve fund in addition is provided for that can be made equal to 10 per cent. on the capital—this fund to be laid by from time to time from the profits in excess of the 10 per cent. dividends.

In addition, there has been legislation regarding the London supply—which originated with the eminent and talented engineer, Mr. George Livesey—known as the "sliding scale," by means of which a great inducement is offered the companies to reduce the initial or standard price, as thereby the dividends may be increased. When a reduction in price to the consumer is made equivalent to $1,000, then the company making the reduction may divide among its stockholders $500, in addition to the 10 per cent. dividend. So that when a

saving is made, by increased attention or economy, or by the adoption of new and improved methods of manufacture or distribution that enables a reduction to be made to the consumer, one-third of it goes to the stockholder and two-thirds goes to the consumer.

By means of this sliding scale, gas stocks in London that were paying 10 per cent. in 1876 now pay 12 per cent. ; and the public seem to be satisfied.

6. There is no question in the mind of your committee that an organization of some kind is a necessity, and that sooner or later it must have an existence ; and yet it is difficult to submit a plan by means of which it can be effected, as there are many interests to be considered, many of which would be opposed to its inception; and it is quite possible that its growth, under the most favorable auspices, would be slow.

Your committee think that it would be necessary, preliminary to the general organization, that an association be made of as many of the more prosperous companies in each State as may think favorably of the plan. When this is done in several States it will be comparatively easy to bring about an understanding between the State associations.

7. Your committee think that an organization properly constituted, and supported and imbued with right principles would advance the interests of the stockholders in every existing gas company in the land ; and that the science and art of the industry would be developed with a certainty and celerity otherwise unattainable. It would surely benefit the public by compelling the companies to furnish the best known lighting and heating agent at the lowest price consistent with a reasonable return on the capital invested.

8. Your committee are fully impressed with the importance of the subject, and regret that they have not been able to present a fuller report. They would respectfully suggest that the committee be enlarged, with instructions to more fully consider the questions involved, and to report to you at a later stage of these proceedings. Respectfully submitted,

EUGENE VANDERPOOL,
A. C. WOOD.

The President appointed the following committees :

On nomination of officers : F. C. Sherman, New Haven, Conn. ; John McDougall, Hornellsville, N. Y. ; G. A. Hyde, Cleveland, Ohio ; F. S. Benson, Brooklyn, N. Y. ; W. H. Pearson, Toronto, Ont.

On the place of holding the next meeting : S. G. Stiness, Pawtucket, R. I. , Edwin Ludlam, Brooklyn, N. Y. ; M. N. Diall, Terre Haute, Ind. ; Thomas Turner, Charleston, S. C. ; L. G. McCauley, West Chester, Pa.

The Association then adjourned until 2 o'clock P. M.

AFTERNOON SESSION.

The Association met at two o'clock P. M.

An invitation from Mitchell, Vance & Co., 836 Broadway, New York, to visit their warerooms, was received and placed on file.

On motion of Mr. Denniston, the address of the President was referred for consideration and report to the same committee to whom had been referred the address of President Hickenlooper.

MR. VANDERPOOL—Is it expected that the committee shall report at this meeting, or is it to be continued, and make its report at the next annual meeting.

THE PRESIDENT—I suppose that is a question for the determination of the Association. Probably it will be best to have the report come before the next annual meeting.

MR. DENNISTON—I had hoped that the committee to whom the two addresses have been referred would make at least a partial report at this meeting, and then continue the subject until the next. If there is not a sufficient number of papers to be read to occupy our time, we can discuss the report of the committee, and act upon the suggestions which they may make.

Mr. Vanderpool—I think the committee will have all that they can properly attend to if they conclude their report upon General Hickenlooper's address, without attempting to go any further at this time. It may be, however, that the gist of what is contained in the address of President Forstall may be included in the consideration of the present committee ; because, I think, in certain respects, the two addresses tend in the same direction.

The President—I think the subject is of sufficient importance to be considered at length in detail ; and the time which the committee will have at its disposal between now and the adjournment will be insufficient to give the matter proper attention. There will probably be a great deal of discussion on some of the points suggested, and their proper consideration may require quite an extensive correspondence with some of the gas companies. I think, on the whole, it would be better to have the subject brought before the next meeting of the Association.

Mr. Denniston—By consent, I will withdraw my former motion, and move that the committee appointed by the chair take the subject into consideration and report at the next meeting.

The President—You mean that they shall consider and report a specific plan of action ?

Mr. Denniston—Yes; on the several subjects treated in the address.

The motion of Mr. Denniston was agreed to, and the Chair appointed as such committee Messrs. Eugene Vanderpool, Newark, N. J., A. C. Wood, Syracuse, N. Y. ; A. B. Slater, Providence, R. I. ; A. Hickenlooper, Cincinnati, Ohio ; Thomas Turner, Charleston, S. C.

READING OF PAPERS.

The President—We will now listen to the reading of a paper by Mr. J. C. Pratt, of Jamaica Plain, Mass., on "The Successful Gas Manager."

Mr. Pratt—Mr. President, it was with more or less hesitancy that I consented to read a paper at this meeting. I was somewhat timid about doing so, and I am more so after listening to your admirable address this morning. You will recollect that I read a paper a year ago which excited considerable discussion. The views which I then presented, or some of them, at least, were new in so far as never having been presented to a convention of this kind. They did not receive the unanimous assent of the members of the Association, and I hardly supposed that they would. In listening to your very interesting address, I found that some of my views, although presented more ably than I could present them, were emphatically indorsed by you ; and I felt gratified, and my timidity has somewhat vanished. The paper which I have now to present will not, perhaps, excite so much adverse criticism as that which I read last year.

THE SUCCESSFUL GAS MANAGER.

The gas manager sustains a two-fold relation, namely, to the company that employs him, and to the people or customers of the company.

Perhaps before I close this paper it may be apparent to you that he sustains only the first relation, and that the latter is absorbed by and included in the former, inasmuch as his duties to the people are so closely identified with the welfare of his company, that he must aim to give satisfaction to the latter in order to produce such results as will satisfy the former.

The successful gas manager is not one that simply earns large dividends for his stockholders, but one who furnishes gas at the lowest price and at the same time satisfies his stockholders with reasonable and adequate dividends.

To accomplish these two results, namely, to satisfy, it may be, a company of greedy stockholders, and sell gas at a price that will give satisfaction to a clamorous public, will tax the energy, ability, sagacity, and industry of the ablest men in our fraternity.

It will not do for the gas manager, if he expects success in this undertaking, to sit comfortably in his office and issue his

orders to subordinates, seldom giving the execution of those orders his personal supervision. Neither will he be a successful manager if he is ever satisfied with present results. "*Excelsior*" should be his motto. *Higher*, *surpassing*, *outdoing*, *going beyond*, should be his aims.

Improvements in the methods of manufacturing gas, and of utilizing the residual products of our industry are constantly being presented; and, while true wisdom does not warrant the acceptance of every new discovery that may be presented as an improvement, the sagacious gas manager will keep himself well posted in all that is said or written by men whose knowledge and opinions on these subjects entitle them to respect and consideration.

Especially will he acquaint himself with the practical results of any improvement or experiment that may be adopted by his brother managers and benefit by their experience.

Nor will he be idle by study, experiment, and skill in furnishing his own quota of knowledge and improvement for the benefit of the great industry in which he is engaged.

The manufacture of gas for illumination, although not by any means in its infancy, is destined to achieve far higher and more important results than it has in the past.

There are many mysterious problems which we discuss year after year, and upon which different, and sometimes opposite, views are presented, that we should be glad to have practically solved.

Napthaline, that almost universal annoyance of the gas manager, and the disturber of his peace—what is its cause? How shall it be prevented from entering our mains and supplies? The stoppage of our stand-pipes—how shall it be prevented?

These two great troubles, to say nothing of others, have long puzzled the brains of gas managers, and he who will discover the grand panacea for them, will tell us how we may obtain the largest yield from our coal, with a satisfactory candle-power, and be exempt from these disturbing elements, will confer an almost priceless benefit upon the gas managers and gas companies.

Gas companies have been so generally successful in earning dividends that there is reason to fear that that strict and careful economy, which other corporations that make money less easily are obliged to exercise, has not been thought necessary by them.

Doubtless with many of us considerable, if not large savings might be made in operating our works, and if sharp competition and smaller dividends stared us in the face, we should be forced to seek them, and in my opinion we should find them. Possibly that period is not so far distant as many of us apprehend.

Confident I am that we have a very large margin in reserve, from which we have made no draught whatever, that will enable us to successfully meet and defy all competition, whether it comes from the electric light, the dangerous death-dealing water gas, or from any other source.

The successful gas manager will see to it that every department of his works is managed with the strictest economy; especially is this true in his labor department.

In a business requiring so much care and skill, the reduction of wages should seldom be resorted to. Nothing is more important for the gas manager than that he should have sober, industrious, and faithful men under him, and they should be kept so, if possible, by paying them a fair and reasonable compensation, and a reduction in wages may be very ill judged, and prove to be a false economy, or rather no economy, if it converts a faithful, industrious employee into a time-serving, dissatisfied, and unfaithful one.

The efficient gas manager will scan his pay roll carefully, and see that his working force is kept down to the lowest possible point consistent with safety and true economy; he may find, that in certain departments savings may be made; he may see where two men can do the work now done by three, or where five can do the work of six, or nine the work of ten.

This is a much better method to economize, in my opinion, than by reducing wages, and if many of our railroad companies and other large corporations had adopted this method, instead of making a general reduction in wages, the serious strikes

they have encountered would have been avoided and the same results would have been obtained.

In the one case, the whole force becomes discontented, turbulent, and in many cases refuse to submit to the reduction; in the other case, the force that is retained, remain loyal, satisfied and contented.

The gas manager should be what the title of his office implies —the "Manager."

He should never allow the expenses incurred in his department, or the performance of the duties of any servant of the company under him, however humble or menial his position, to escape his personal supervision.

The manager is responsible for the success or failure of his company, unless he is trameled by an unreasonable board of directors, which is seldom the case; it is not upon the subordinates he may employ that the blame of failure, or the praise of success, will fall; *he* alone is responsible; upon *his* shoulders will rest the mantle of praise, or the burden of condemnation, according as good judgment, industry, and wise economy, or carelessness, inefficiency, and extravagance may characterize his administration and management.

The only way by which he can ensure faithfulness and economy in every department is by constant watchfulness and personal supervision.

The most faithful employee, if he knows he is not carefully watched, and his work constantly inspected, will, as a rule, become lax in the performance of his duties, not so much so, perhaps, as to merit severe censure; his routine of duties, may be performed with formal, compulsory, treadmill regularity, but not with the prompt, vigorous, energetic force of a man who feels behind him the impulse and authority of one who is responsible for, and is determined to achieve results, and who, if he fails, must lose his position and reputation.

The gas manager should also fully appreciate, and constantly keep in view the fact, that while the strictest economy may not be necessary to earn the regular dividends of the company, he owes a duty to his company, no less binding upon him, to exercise the same strict economy and supervision to enable it to

supply gas to its customers at the lowest possible price ; and if strict and severe economy be not necessary to enable the company to pay large dividends, it is necessary and the obligation and duty are no less binding, in order to reduce the price of gas to the public, and give it what it is entitled to, and which the stockholders do not require.

The gas-manager to accomplish these results must be an able man, an energetic man, a vigilant man, an economic man, one who knows what every subordinate is doing, who scrutinizes every statement and report they make, and tests their accuracy ; he must command the position in every detail, responsible for the faithful performance of his duties to his directors only, and be willing to assume the responsibility of his work.

The gas-manager should not only possess the qualities I have mentioned, but he should be endowed with a large share of that rare and commendable virtue, *patience ;* he should be a gentleman in the best sense of the word, but more especially a patient, good-tempered gentleman.

It is a very common saying that there are only two things certain in this world, "*death and taxation,*" both universally disagreeable to contemplate, and to which many would add a third, as hardly less sure to appear and viewed with similar feelings of dread, apprehension and terror, namely, "*The Gas Bill.*"

From the earliest time the tax-gatherer has not been an agreeable personage ; under the Roman government the taxes were farmed out to rich capitalists, and sometimes to joint stock companies, who, through their subordinates the "Publicani," or publicans, had the power, and most ruthlessly exercised it in oppressing the people by extortion and fraud, and the severest expression of contempt of the proud Pharisee for the Saviour was the sneering remark : "He eatheth with Publicans ; and so profound is the belief of many people that gas companies and gas managers are swindlers, cheats, and extortionists, that, if the Saviour should appear on earth again, and be found in our company, it might be sneeringly said of him, "*Behold He eatheth with gas managers !*"

How few persons are absolutely satisfied with their gas bill.

I by no means wish to be understood as saying that every man disputes his gas bill—a very small portion of our customers do that—but it is a fact, which I think all will admit, that no bills are paid more grudgingly, and with less pleasure, than the inevitable gas bill.

It is the common practice of people who are dissatisfied with their gas bills to condemn the meter, and too often to apostrophise their condemnation by the shorter word "damn," which has the same meaning, and not only apply it to the meter but to the gas company and all its officers.

We know that there is no good reason why a man should fly into a passion over his gas bill any more than over his grocer's bill; these bills he examines, and if any of the items are wrong he has them corrected; and he has it in his power to examine his gas bill and test its accuracy with more certainty than he can his grocer's bill, and the latter has greater opportunity to defraud him than the gas company.

The trouble is that almost the only thing about which a man will not listen to any explanation is his gas bill; he has but one answer: "I have not used the gas and I will not pay the bill."

The rage of a man who appears flinging a disputed gas bill in your face is sufficient sometimes to intimidate the bravest; how is this man to be treated? Not with a counter-irritant certainly; the patient, good tempered, gentlemanly gas manager understands how to deal with him, he knows what human nature is, he knows that this man, in most cases, is honest, but uninformed and ignorant of what he is talking about, and he knows too that he is not in a frame of mind to be taught anything; information, knowledge, is not what he seeks, but justice he fiercely demands.

The wise manager, however much he may be irritated by the torrent of abuse that may have been poured upon him and his company, does not lose his temper, nor does he attempt to reason or argue with him; perhaps he blandly smiles, and assures him that his bill will be investigated, and if incorrect will be made right, and that he will do all in his power to satisfy him; and

in nineteen cases out of twenty will satisfy him without changing a figure on the bill.

Perhaps after his tempest of passion has subsided he will explain to him that the meter which he denounces as a fraud is as perfect an instrument as human ingenuity has been able to make it, simple in its construction, the dials on its face exposed to view, and indicating with clock-like accuracy every foot of gas that passes through it; and anybody who can read the time by the face of a clock can read these dials and ascertain for himself whether his bill is correct or not, and this it is his duty to do before complaining of his bill.

And so he makes the man his friend and the company's friend.

Nothing pays so well as an investment as good nature, and the man who cannot control his temper and wear a pleasant face, and have a soft answer under the greatest provocation, lacks an essential qualification of a good gas manager. How truly the wise man said, "He that is slow to anger is better than the mighty, and he that ruleth his spirit than he that taketh a city."

And it may be added in this connection that the man who controls his temper is the best disciplinarian, and has much greater influence with and control over his men than the man of a violent temper.

How often do we see this to be the case in many positions; the commander of a regiment, the captain of a ship, any man, whatever his position in authority over men, can more easily secure obedience and respect by maintaining his own self-respect, which a violent man seldom does. Abuse, profanity, vulgarity, may win obedience for the time, but it will be an eye-serving obedience; they will not secure honesty and faithfulness.

The successful manager is a man who combines strictness in discipline, fearlessness in every emergency, with kindness and respectful treatment to all his subordinates.

He need not be a despot in his little kingdom, for that would be to act the tyrant; but his power must be absolute, his smile or frown should have more significance than speech; a man of

few words, but those words so clear, so strong, so decided, that obedience is a necessity. Rebuke from such a man stings, but does not lacerate, while the recipient feels that he is recognized as a man and not treated as a brute.

One of the most important duties of the gas manager is to satisfy and please the people, to gain the confidence of the people, to convince them of his strict unswerving integrity, and that no consideration can possibly induce him to be a party to fraud or dishonesty; and when this confidence is gained, he will have little trouble in adjusting any differences that may arise between them and the company.

A gas company cannot afford to have a manager who snubs, or treats with incivility or indifference a complaining customer, no matter how unreasonable may be his complaints.

More than one large company could well afford to pay the right man a large salary to stand in the office and do nothing but smile at every grumbler who approaches.

Now, gentlemen, I have endeavored to give you my views of some of the essential qualifications of a successful gas manager, as well as the two-fold relation of the manager to the people and his company; and, as I intimated at the beginning, the latter absorbs and includes the former; in other words, the efficient gas manager will recognize the fact that his duties to his company demand of him that kind, forbearing, conciliatory treatment of its patrons that will win their confidence and convince them that he is no less their friend than the friend of the company, and that he is striving no less earnestly to cheapen the commodity he furnishes them than to earn dividends for his stockholders, and thereby create and maintain those relations which will promote the best interests of the company whom he serves.

THE PRESIDENT—Mr. Pratt seems to have covered the ground so thoroughly that there is little room for discussion on the subject.

On motion of Mr. Slater, the thanks of the Association were tendered to Mr. Pratt for his excellent paper.

AFTERNOON SESSION—OCTOBER 17.

THE PRESIDENT—The next paper is by Mr. George Cornell of Youngstown, Ohio, on "The Proper Location of Meters in Buildings."

Mr. Cornell thereupon read the following paper:

THE PROPER LOCATION OF METERS IN BUILDINGS.

Having had our attention lately drawn to the question of the proper location of meters in buildings, we have thought that it might be both interesting and useful to collate the experiences and views of gas managers on that subject. Without knowing the practice of other companies to any extent, it has seemed best to us to have the meters placed in the cellars of buildings, or, in some cases, on the main floor, but generally, and preferably, in the cellar. We have carried out this rule for a number of years without trouble; but this year a party has built up a fine business block in our city, and contested vigorously our rule as to the location of meters, desiring us to place the meters for each floor on that flour up to the fourth story—the reason for this request being that the expense for gasfitting would be less than if all the risers were carried to the cellar and the meters collected there. The gas company carried its point in this case by making some concession in the expense of running pipes. Without futher introduction, we will proceed to give our reasons for the rule we have established.

1. It is better for the meter itself to be kept in a place the temperature of which is moderate and equitable, rather than in a place in which it will be subjected to extremes of heat and cold. Some of our earlier settings were of this latter sort; and I have in mind some meters placed on a landing over the entrance and stairway of a block, with a southern exposure, so that the noon-day sun of a summer day streaming through the window near them might raise the temperature to 120 deg. Fah., and the rigor of a winter night would have perfect freedom to cool them to a point below zero. It will not be disputed, I suppose, that the meter will work more regularly and

correctly, and will continue longer in working condition, if placed according to the principles mentioned.

2. The greater convenience of inspecting, setting, and removing meters when placed in the cellars of buildings, is a consideration of importance. The frequency of these operations, and the importance of them, render it necessary that meters should be in a position readily accessible to the inspector or workman, so that his important duties may be rapidly and comfortably performed. And not only are the interests of the gas company thus promoted, but the comfort of our consumers will be enhanced by confining to the cellar all those little escapes of gas and drippings of condensation which occur in the handling of meters.

3. Another important object secured by placing meters in the cellars of buildings, is that the work of the gas company is thereby kept more distinct from the work of the gasfitters than it could be if meters were placed on every floor through the building. In case of a leak occurring in a building, the single question whether it is in the cellar will determine, to a great extent, the responsibility of the gas company, and the character of the action necessary to be taken in the premises.

4. And finally, we may say that order, system, and arrangement are valuable in any business. That if there should be "a place for everything, and everything in its place," surely every part of the great enterprise of furnishing artificial light should be according to wholesome rules and regulations, and nothing should be left to fix itself at haphazard, for this is not consistent with the dignity of our profession, or the value of the services we render to the community.

DISCUSSION.

THE PRESIDENT—The subject of the location of meters is one which according to my remembrance, has never been considered at any meeting of the Association. It is a subject as to which there may be some difference of opinion.

Mr. Monks—For the sake of carrying on the argument, I will take exception to the views of the gentleman, and state the other side of the question, so far as I know it. In Boston, where I reside, I have charge of a number of large buildings; and instead of placing the meters in the cellar or basement, it has been our custom, in such buildings, to place the meter on a shelf in the hall on each floor. I think that is the plan followed in most of the large buildings in that city. So far as escape of the gas is concerned, it is very evident that if there is an escape of gas on the second, third, or fourth floors of a building, it is no business of the gas company's. According to my observation, a majority of the accidents which have occurred from escaping gas, have resulted from placing the meters in a confined situation. The South Boston Company knows that as much to its cost as any company in the land, having had an escape of gas between two sidewalks which blew up the entire footway, and cost the company $32,000 before it got through with the explosion. If you place the meter on a shelf in the hallway of a large building and there is any escape of gas, it is very quickly reported to the company; whereas, if the meter be placed in the cellar, or in a confined place, the escape does not get reported as quickly, or else somebody who is not familiar with the action of gas, under such circumstances, takes a candle and goes down to the cellar to see what the matter is—and he finds out what is the matter in a hurry. I believe that it is better to distribute the meters in large buildings upon the various floors, keeping them in the hallways rather than in the rooms, as a matter of safety, and as a matter of convenience as well.

Mr. Jones—Sometimes in the building of flats, where three or more meters are to be set to supply as many different floors, the gasfitter will leave connections with the couplings on them hanging in the cellar, without specifying in any way for which flats the several connections are; and, consequently, when our man who sets the meters goes to the cellar for that purpose he is unable to ascertain, except by blowing through the services of the house, which shelf the meter goes on for a certain flat.

If the meter is set in the flat to which it belongs, it greatly facilitates the work to be performed by the meter man. I think it is sometimes an advantage to have the meter placed on the floor where it is to supply the gas used.

MR. PRATT—In the paper which I read I refer to the meter as being an instrument as nearly perfect as human ingenuity can make it, and stated that it was easily read. Sometimes I state to dissatisfied customers, " You can go and see the state of the meter for yourself ; " and the reply is that we have put the meter in a dark corner of the cellar where they cannot see it, and that our man, when he goes there to see the meter, has to take with him a lantern. Therefore, I believe that it is best to have the meter placed in some position where it can be seen and read by the consumer, as in the back hall, or in some convenient place where it will be exposed to the light, where the consumer can examine it without trouble, and have no excuse for not knowing what it records.

MR. GIDEON WOOD—There are some points in this matter which have not yet been brought out. Gas companies think something of the safety of their meters, as they are not insured. I think a meter is more safe in a cellar than it is in a chamber. In New Bedford we have, until recently, set our meters largely in the basements ; but finding this difficulty, which my friend speaks of, of not being able to see them readily, we have endeavored to have them placed on the first story. We do not like to put them in the chambers of the second or third story, as, in case of fire, it is then very difficult to get at them, and they are always sure to be burned ; and it is frequently very troublesome to get at them when so situated. If they are all on the first floor, no matter if there are five or six meters, when the man goes to take a statement he takes from all at once, because they are right under his eye. It costs no more to carry the gas from there into the chambers than it does to carry the services. It is about one thing. It costs about as much to carry the pipe, whether it is before the meter or after it. There must be a service from the meter to the feeder; so that there is no great difference as to the cost

whether the meter be placed in one part of the house or another. But there is an advantage to the gas company in having the meter where it will be safer, and where it can be most readily taken. It occupies a man much longer to take six meters in a building where they are scattered over as many different floors, than it does if they are all placed on the first story, and so can take them all at once.

Mr. Starr—In our place we do not like to have the meter in the cellar or in the hall. We endeavor to set the meter up stairs underneath the front window. That is a dry place, and they are there protected. If placed in the hall they are liable to freeze. We have just put meters in a house where they run the service pipes to the fourth story, and a meter has been placed in each suite of rooms, just behind the door, where it is protected by having a little box over it. Thus each consumer has the meter where he can conveniently see it, and can turn the gas off whenever he wishes to. If there should be any leak of gas it is bound to be noticed very soon.

Mr. Pearson—You are very much less liable to have your pipe tapped, to the cost of the gas company, if the meter is placed in the cellar. If the meter is placed up stairs it is quite easy, when new gas burners are put in, to have the gasfitter make the connection below the meter, and the consequence is that the gas passes away without being registered on the meter. I have known several cases of that kind. Whenever we can put the meter down near the service pipe we do it—to a very large extent, it is done on that very account.

Mr. McMillin—There is an objection to putting the meter in the cellar which has not been stated. Suppose a gas company supplies five hundred stores. The meter is usually placed at the end next to the street, while the entrance to the cellar is usually at the back end of the store; and so, when the man goes to take the meter, he has to walk to the back of the store, then to the front of the cellar, then again to the back end of the store, and then the length of the store to reach the street again. I have not made a calculation of the distance he would have to travel in reading 500 meters thus placed, but I

think he would have to do 15 to 25 miles extra walking to read those meters. The best reason that can be urged for placing the meters in the cellar is the uniform temperature; but my friend Starr suggests that they be placed under the show windows of stores, which is almost equally as good a place. I have been interested in a place where they have been obliged to take all the meters out of the cellars, because, during the annual floods, the meters would not float worth a cent. The water would twist the meters out of place and break the connections, for this reason we were obliged to put them up stairs, and sometimes in the second story.

On motion of Mr. Sherman, the thanks of the Association were tendered to Mr. Cornell for his interesting paper.

THE PRESIDENT—The next paper is that of Mr. T. B. Fogarty, on "A New Process of Manufacturing Water Gas."

Mr. Fogarty then read the following paper:

A NEW PROCESS OF MANUFACTURING WATER GAS.

Mr. President and Gentlemen of the Association:

Upon the occasion of your last meeting I had the honor of presenting to you my views upon a new process of making water gas, and, in accordance with the promises then made, I will now claim your attention for a short space while I present to you a brief review of the progress made by myself and others who are working upon nearly the same lines, in the simultaneous production of heating or illuminating gas and ammonia.

I have no doubt but that a year ago many of you, to use a gentle expression, regarded as visionary and absurd the proposition which I then put forward; and yet much of what I then proposed as a theory has since been realized by me in a manner scarcely hoped for at the time, while the success achieved by others who are working in the same direction has startled the gas world, and all but made a brilliant and startling reality of the prediction that, "in the near future, gas would become a residuary product of the ammonia manufacture."

A year ago I stated to you, upon the authority of Dr. J. M. Tidy, that the ammonia obtained in the coal gas manufacture constituted but a small fraction of what the coal was capable of producing, and suggested that it would be well worth the while of such of you as are engaged in the manufacture of coal gas to turn your attention in this direction.

During the past year much light has been thrown upon this subject by the researches of Prof. W. Foster, who, in December, 1882, read before the London Chemical Society a most valuable and instructive paper upon this subject, showing that, of the nitrogen contained in the coal

14.50 per cent. was evolved as ammonia in the gas manufacture ;
1.56 per cent. was converted into cyanogen;
34.04 per cent. was unaccounted for, and believed to be almost entirely in the condition of nitrogen in the coal gas;
49.90 per cent. remained in the coke.

From this it will be seen that but 14.50 per cent. of the ammonia capable of being evolved from the coal was obtained from it. These figures are rather startling and suggestive, but become more so when supplemented by Prof. Foster's statement that "100 tons of ordinary gas coal are capable of producing nearly 9.4 tons of ammonium sulphate, whereas, in practice, one ton is usually considered a good yield."

Prof. Foster's figures receive a most startling and significant corroboration from the practical results obtained by Mr. Young, of Clippens, as described by him at a late meeting of the North British Association of Gas Managers. According to Mr. Young, his process is now in full operation upon a large scale—from 270 to 300 tons a day of shales being distilled under it for the production of oil, and from 12 to 15 tons of gas coal being used for fuel at his works. His practical results show that he produces an average yield of 95 pounds of sulphate of ammonia per ton of shale, out of a possible yield of 115; while from each ton of coal used for fuel he obtains an average result of 43.55 pounds of sulphate and 12.52 gallons

of oil, a quantity which he declares to be more than equivalent to the first cost of the coal.

The oil manufacturers are by no means alone in their efforts to produce increased quantities of ammonia. Other and most important sources of this product have, I may say, sprung into existence during the past year, and are now being rapidly developed.

I learn from an English publication that the project of distilling coal at the pit's mouth, for the sake of the tar and ammonia to be obtained from it, is now being seriously considered by the English colliery proprietors, the gas to be regarded as a residual, and used only as fuel. I also learn from the inaugural address of Mr. Robert Tatlock, President of the Philosophical Society of Glascow, that the Scotch ironmasters are now recovering the ammonia contained in their waste furnace gases. That one ton a day of sulphate was then being made at one iron works from the waste gases of two furnaces, and that all the remaining furnaces at these works were being adapted as quickly as possible to the recovery of the ammonia. Mr. Tatlock tells us that this movement is becoming general among the Scotch ironmasters, and then enters into a calculation showing that 130 Scotch furnaces, capable of being adapted to the recovery of the ammonia in the waste gases, could, in this way, be made to produce 25,000 tons a year of sulphate—figures which are at least suggestive, when it is considered that the entire present product of Great Britain does not exceed 65,000 tons.

The coke manufacturers, too, are rapidly falling into line. It is now not more than a year since Mr. Jameson first started the idea of utilizing the waste products of the coke manufac-
yet, within this short period, considerable progress
this direction, several improved coke ovens
erected, and being now in practical and

sses introduced with a view of preserv-
idual products of the coke manufacture,
ems to have attracted the most atten-

tion, it being generally admitted that, by means of it, a ton of ordinary caking coal may be made to produce about 6 gallons of oil and 15 pounds of sulphate of ammonia.

I also see it reported in a late number of *Engineering*, that 25 Simon-Carves ovens, as an average of seven months continuous working, have been producing 6.12 gallons of oil and 27.20 gallons of 12-oz. ammoniacal liquor = 17.84 pounds of sulphate to the ton of coal. Indeed, the practical results of the Jameson and Simon-Carves systems of coking have already proved so profitable that the universal adoption of these, or some other similar systems, is now assured; so that, in estimating the future yield of ammonia, it is perfectly safe to take into account the product of the coke furnaces, especially as the alterations required are very trifling, and the additional cost of coking is about two cents per ton.

I have at hand no data of the entire yearly production of coke; but it must be enormous, for I find that in England alone 20,000,000 tons of coal are annually consumed for this purpose, which, at an average yield of 15 pounds of sulphate per ton, would give 135,000 tons—more than twice the entire present product.

Another source of ammonia, to which considerable attention has been directed during the year, is what is known as the Cooper process of gas making. The theory of this process, with much show of reason, assumes that, while alkali does not enter directly into the composition of ammonia, the formation of the latter is almost entirely dependent upon the alkali contained in the coal—generally 50 or 60 pounds to the ton. Bearing this fact in mind, Mr. Cooper claims that the alkali in the coal does not of itself suffice for the conversion of the nitrogen present into ammonia, and undertakes to supply the deficiency by mixing lime with his coal—generally 50 or 60 pounds to the ton.

While great advantages have been claimed for this process, it does not appear that they have been realized in practice, at least not directly; for, while there seems to have been considerable increase in the yield of ammonia, this gain appears to be offset, to a great extent, by the cost of the operation.

Another and unexpected source of ammonia, and one the extent of which it is impossible to estimate even approximately, has arisen in the application of a patent, lately granted to Mr. H. L. Armour, which has just been made at an English coal mine. It is well known that at the mouths of most coal pits there is a large accumulation of coal dust, shale, and iron pyrites, for which no market has been found. These dirt heaps are generally on fire, and give rise to such volumes of smoke and dust that they become a nuisance to the surrounding neighborhood. Under Mr. Armour's patent, a burning mass of this sort has been covered with sand, a number of pipes, connected with a suitable main, have been inserted, and, an exhauster being applied, a large volume of gas, rich in oil and ammonia, is obtained, at the mere cost of running an exhauster.

In addition to the above sources of ammonia, it is now suggested that the Leblanc soda manufacturers should entirely cease to use raw coal as fuel, and convert it all, except that used for mixing in the black-ash process, into coke under the Jameson system, collecting for sale the oil and ammonia, and using the gas for fuel being, impelled to this course through fear of being driven out of the market by the alkali manufac turers working under the Solvay process.

I have thus far endeavored to pass in review some comparatively new processes for the preservation and utilization of coal products, which have heretofore been wasted, in the hope of conveying to you, as far as the limited scope of this paper will permit, a faint idea of the tremendous progress which has been made, and the splendid success which has been achieved by others in this direction during the past year, and shall now endeavor to make you acquainted with my own progress during the same period.

It is known to many of you that for some years past I have been engaged in the development of a new process for making water gas, the principal feature of which is that, simultaneously with the gas, I produce ammonia and carbonates of soda. For the past year I have devoted myself almost exclusively to

the development of the process, and I am now happy to be able to say to you that I have reason to be more than pleased with the result of my labors.

At your last meeting I endeavored to trace, as clearly as I could, the principles and details of a process which, it is true, had been carried out successfully on a purely experimental scale, but which, at the same time, had never been tried under anything approaching practical conditions; and I consequently had no reason to complain of your being somewhat sceptical upon the subject of a process which was still little more than theoretical.

I regret that upon that occasion I was unable to speak to you as openly and clearly as I could have wished; but I was forced to a certain measure of silence by the pendency of some American patents, as well as by my being about to take out some foreign ones, which I would have been debarred from obtaining by a previous publication of their subject matter. This obstacle, however, having been now removed, I am prepared to make you a full and unreserved report, neither concealing the many failures and mishaps I have met with, nor exaggerating whatever measure of success I have attained.

I have to report, in the first place, that I have not yet been able to carry the process out practically upon a large scale; but, at the same time, I have thoroughly tested it under such practical conditions as enable me to make definite statements as to its practicability and economy. When I say this, however, I wish you to understand that such tests and experiments as I have made have been exclusively confined to the synthetical production of the ammonia, this being, in fact, the keystone of the process, and the only part of it upon which any doubt was ever thrown, or in which experiment was necessary. I need scarcely say to you that the entire success or failure of the process depended upon the amount of ammonia I could produce, the cost of its production, and the facility of carrying out the process in practice.

In my first experiments, which were made upon a very small and purely experimental scale, I endeavored to carry out the process by passing generator gas, containing from 50 to 60

per cent. of nitrogen, through alkalized carbon contained in an externally-heated retort. I should state that I took great pains to prepare and mix intimately my carbon and alkali, and such as could not possibly be taken in practice. As I stated to you last year, I found no difficulty whatever in producing ammonia, and correspondingly reducing the nitrogen in the gas; but I very soon became convinced that this method of carrying out the process was perfectly impracticable, and could not be practiced economically upon a manufacturing scale.

My own experiments, as well as the recorded experience of Messrs. Possoz and Boissiere, convinced me that the path to success lay in the use of externally-heated retorts—that is, in superheating my generator gas, and, in this state, causing it to pass through the carbon and alkali contained in the retort, the heat required to produce the desired reactions being furnished by the gas itself, in the same way that the conversion of naphtha into gas, in the Lowe water gas process, is effected by the heat of the gases produced in the generator.

In accordance with these views, I now endeavored to carry out the process by passing incandescent generator gas through breeze and alkali mixed together, and brought to incandescence. I found, as before, that I could produce ammonia without difficulty; but the quantity obtained was so small in proportion to the amount of material used that I became convinced that the process could not be carried out economically in this way.

A little reflection, aided, as before, by a leaf from the recorded experience of others, soon led me to discover the cause of failure. I found that the formation of cyanogen takes place only upon the surface of the carbonaceous matter acted upon. In my experiments I had been compelled to use coarse breeze screenings, so as to render the mass in the retort permeable to the hot gases; and the inevitable consequence was that the weight of surface matter acted upon, and the consequent weight of cyanogen produced, were insignificant in comparison with the weight of material employed.

It now became evident that to insure success I must use my carbon in as finely divided a state as possible—that is, pulverized—as will be seen by the following simple calculation:

A 1-inch cube has a surface of 6 square inches; but if we subdivide it into half-inch cubes, we will have eight of them, with an aggregate surface of 12 square inches; divided into one-quarter inch cubes, the same bulk and weight of material will give us 24 square inches of surface; and so on, until we find that, by reducing an inch cube to a finely divided or pulverized condition, we are enabled to obtain several thousand times more surface from it. The inference was clear. I would be compelled to use the material in a finely pulverized state, and this, of course, involved a specially-arranged apparatus.

This was the state of affairs when I had the honor of introducing the process to your notice at your last meeting. I had made considerable progress in studying out the best methods of carrying out the invention. The process was, to all practical purposes, a failure; but even this very failure satisfied me that it was entirely owing to mechanical conditions, for I found my views, as to the chemistry of the process not only sustained by my own experience and the recorded experience of others, but also most fully corroborated by eminent chemists to whom it had been submitted.

I was now satisfied that, to make the process a success—

1st. The reactions must be produced by internal heat;

2d. No effect could be produced except at a temperature sufficient to vaporize the alkali used;

3d. The carbon used must be in a finely-divided or pulverized state, so that it may present as large a surface as possible to the action of the incandescent gas and alkaline vapors.

A little consideration will show that before attempting to carry out upon a practical scale a process involving the application of the above conditions, a great many fine points had to be studied out, and many tests had to be made; and that all this involved the expenditure of much time and labor.

The first experiments with pulverized material were made with a narrow cupola about twenty feet high, and reduced by fire brick lining to an internal diameter of about eight inches. This was connected at the bottom with a superheater which, though not all that could be desired, was yet considered sufficient for the purpose of the experiments. The superheater was in turn supplied with gas from a suitable generator. The pulverized carbon used was finely-sifted anthracite screenings, and was mixed with caustic soda, the mixture being fed by hand into the top of the cupola through a small hopper.

The experiments were at first unsuccessful, owing in great measure to the temperature being too low; but this having being raised without producing appreciable results, repeated experiments made it apparent that, while the temperature may have been originally, and indeed might be yet somewhat to blame, the chief cause of failure must be sought elsewhere. At the close of many vain efforts to make the thing work, I concluded that very probably the time occupied by the pulverized carbon in falling from the top to the bottom of the cupola was too short, and, with a view of obviating this difficulty, filled it for about fifteen feet with fire brick placed upon edge, upon and across each other, so as to form a reticulation, as in a superheater, and thus produce a series of bafflers. The effect of this was that I could certainly produce ammonia but not in a desirable quantity.

After considerable disappointment and delay, I was one day examining the pulverized material which had fallen to the bottom of the cupola, when I was struck by the small quantity of alkali which it appeared to contain. This led me into a train of thought which satisfied me that the alkali became vaporized in the upper part of the cupola, and becoming separated from the carbon which fell to the bottom before any reaction took place, was carried off by the gas escaping from the top of the cupola. Up to this time I had been introducing my superheated gas at the bottom of the cupola and my alkalized carbon at the top, with the idea that this latter becoming gradually heated as it fell would be readily raised to its high temperature by the superheated gas entering the cupola, the latter being the hottest at this point.

My next step was to arrange the cupola so that the superheated gas would enter it at top and would escape at bottom, and that thus the alkaline vapor and incandescent gas would meet the volume of pulverized carbon in the body of the cupola, accompanying and enveloping it as it fell. The immediate effect of this change was that, even at a temperature which would previously produce no results whatever, I was enabled to obtain large quantities of ammonia without difficulty. I am now satisfied that I have successfully overcome the mechanical difficulties in the way of a practical application of the process; and that I can produce the ammonia at will and upon a scale of any magnitude.

You will scarcely be surprised when I tell you that nearly my entire time during the past year has been occupied in arriving at the results which I have just given. I did expect to be able to give you exact quantitative results as regards the production of the ammonia; but I have found it impossible to do so. I may say this much, however, for the information of the meeting—that everything at present indicates that I shall have at least 30 pounds of sulphate of ammonia for every thousand feet of gas made; while it is more than probable that I shall obtain 50, and this at an expense of not more than ½ cent a pound plus the cost of the acid. By this I mean that the making of the ammonia will add about 15 cents per thousand to the cost of making the gas, which at a minimum production of 30 pounds to the thousand feet would make it cost not more than ½ cent a pound. In addition to the ammonia there will be a large profit from the carbonic acid produced, which, of itself, ought to repay the entire cost of making and distributing the gas.

The amount of material required to produce the ammonia cannot be arrived at definitely with the very imperfect apparatus which I am using; but I am satisfied that the expense on this score will be practically nothing, as I can readily explain.

I have found that, as a sub-process in the operation, metallic sodium is invariably produced by the same process by which it is now manufactured extensively according to the plan of St.

Claire Deville, who heats together an intimate mixture of carbon and soda, with the result that the carbon decomposes the soda, and combines with its oxygen to form carbonic oxide, metallic sodium being set free. This is exactly what takes place in my process. An equivalent of carbon combines with the oxygen of the alkali, which is reduced to a metallic state, and in this condition combines with the carbon and nitrogen to form an alkaline cyanide. In this way the gas suffers absolutely no diminution of volume, for every atom of nitrogen removed from it and converted into ammonia is replaced by an equivalent of carbonic oxide, which, in turn, has substituted for it an equal volume of hydrogen.

In like manner, the alkali used is immediately recovered, less the waste which invariably accompanies every manufacturing process, and may be used over and over again, its waste being in fact the only material to be taken into account in estimating the cost of producing the ammonia. As far as I can see, the expense of producing the ammonia will add for fuel, labor and waste, not more than 15 cents a thousand to the cost of the gas.

You will now naturally say that if, in addition to the large quantities of ammonia which are now being produced, and the enormous increase of production which, as I have shown you, is sure to come in the near future from sources other than my process, this will lead to the production of such enormous quantities, as I am now certain it will, the price of ammonia will be reduced to a point at which there will be no profit in producing it. A few words upon this very important point and I shall close.

In the preface to the English edition of his great work upon chemical manures, Mr. George Ville says: "It is an undeniable fact that, except under rare and almost exceptional circumstances, farming operations carried on solely by manure produced upon the farm itself, have for a long time ceased to be profitable." And he insists in the strongest manner, that to the nitrogen which they contain, more than to anything else, chemical manures owe their value. It is a fact beyond dispute that a ton of ammonia represents its equivalent in wheat, and

beef, and potatoes, and rice, and tobacco, and sugar, and every other form of food produced by civilized man; and it should not need much argument to convince you that, while this is so, the value of ammonia cannot fall below that of the products which may be derived from it. Why, many of our Connecticut farmers find it profitable to spend $400 an acre in manuring their tobacco fields.

The trade in fertilizers is enormous. Year by year more and more of our farms are becoming impoverished to such an extent that they must be abandoned or manured, and just in proportion as this is so, and still further, in proportion as our farmers are becoming alive to the enormous advantage to be derived from the use of chemical manures, does the demand for them increase.

Ten years ago the use of chemical fertilizers was almost unknown in the United States, and yet I find from a report just published at Baltimore by the National Fertilizer Association, that the consumption of chemical manures in the United States for the past year was about 850,000 tons, worth about $25,000 000; and that of this enormous quantity Baltimore alone produced 350,000 tons, and yet the business is in its infancy. No, gentlemen, you need not fear that there will be an over-production of ammonia while there is a market for the products of the soil. On the contrary, the demand for it must increase enormously, as our population increases and our farming lands become unproductive, as they must surely do under the present system of taking all from the soil and restoring nothing to it. And in proportion as the demand for ammonia increases, so will the ratio of its production increase also. In proportion to the ever increasing demand for it, so are men's minds turned to the discovery of new sources of supply. The coal consumers of the world, whether producers of gas, or coke, or iron, are becoming alive to the enormous value of their waste products, and it behooves us here, gathered as we are for the interchange of experience, and for mutual advantage, to keep our place in the race of improvement. This world of ours is moving at a speed which our fathers never dreamed of, and be assured, if we do not move with it, it will overtake and overwhelm us in its course.

I thank you, gentlemen, for you kind attention.

DISCUSSION.

The President—You made a statement last year that under your process gas could be made for 75 cents less than nothing. After a year's experience do you desire to amend those figures, or are you now prepared to say that you can do it for $1 less than nothing?

Mr. Fogarty—That is the only way in which I would amend it. I am satisfied that I can produce with proper apparatus, not less than 50 pounds of the sulphate to every 1,000 feet of gas, and 60,000 feet of gas from every ton of coal. I mean non-illuminating gas.

The President—We would like to hear from Mr. Bradley on that point, as I believe that he is a water gas man.

Mr. Bradley—I have nothing to say in that direction. I have never followed out the particular line indicated by Mr. Fogarty, and therefore am unable to say much about it.

Mr. C. Nettleton—I wish to ask Mr. Fogarty whether he means us to understand that he makes 60,000 feet of gas from a ton of coal, and 50 pounds of ammonia to a thousand feet of gas? In other words, does he make 3,000 pounds of ammonia to the ton of coal?

Mr. Fogarty—Yes; that is it. I know that it can be done.

Mr. Allyn—At the last meeting Mr. Fogarty consumed nearly a whole session of the convention, as he has done to-day. When he commenced to-day, I think that every member of the Association believed or hoped that he was going to give us some practical results; but, excepting the extracts which he has read from English publications, he has given us nothing practical. I might say that I supposed I could make 20,000 feet of gas to the ton of coal, but I should not think the idea was worth mentioning here unless I could bring some proof that I was able to do it. I think Mr. Fogarty has taken up so much time in the statement of his theory that it is now better to let the matter drop until he gets ready to give us some actual results which he has obtained, and then it will be time

enough to bring the subject before the Association for discussion. I therefore move that the debate upon that paper be now closed.

MR. STINESS—We have been sitting here listening to Mr. Fogarty's statement of how to make ammonia. I supposed we were to learn from him how to make water gas. We can visit works but a very short distance from here and have a practical illustration of how to make a good, merchantable article of water gas; and we learn nothing new about the process from the paper which Mr. Fogarty has read. I hope that debate on the subject will be closed.

The motion to close debate on the subject of Mr. Fogarty's paper was carried.

MR. C. H. NETTLETON—Is there any other paper to be brought forward this afternoon?

THE PRESIDENT—Not unless Mr. Sloane is in the room. He has a paper which he expects to read, but he is not now here to read it. Mr. Goodwin will also give us a paper to-morrow.

MR. C. H. NETTLETON—Then I ask that Mr. Stedman read some figures which he has brought relative to regenerator furnaces.

THE PRESIDENT—We shall all be pleased to hear from Mr. Stedman.

REGENERATOR FURNACES.

MR. W. A. STEDMAN—I may say that I have not carried my experiments far enongh to warrant me in presenting a formal paper on the subject of regenerator furnaces, or I should be very glad to submit the results at this meeting. As the painters say, when they are about producing a *chef d'œuvre* in the way of art, it is a sort of preliminary sketch or study which we have been making in the practicability of regeneration and recuperation. My main object has been to attain simplicity of apparatus and economy of production. A year ago last April I started a furnace of very simple construction, and obtained only very moderate success. We did succeed in reducing

somewhat the quantity of fuel required to produce 1,000 feet of gas; that is, we used less than we did in the old furnace, but the result was not satisfactory, because we could not get as much gas per bench as we did in the other. The bench was rather crude, and we found that the air which supplied the supplementary combustion leaked into the waste-gas flues and vitiated our results. Last spring we made a more complete bench, using the experience which we had gained in the previous year, and took great pains to prevent the supplementary air supply from going into the waste-gas flues before it went into the furnace and did its work; and so far the result justifies us in the belief that we have succeeded in making perfectly tight air flues, so that we can heat them by the waste gases, and not intermingle the atmosphere and the waste gases at all. We started this bench in the latter part of June or the 1st of July, and got it up to working heat about the 10th of July. Since that time we have been charging it steadily, and sometimes have charged it pretty heavily, being obliged sometimes to call upon it for all it was worth. I have embodied the results in some memoranda which I have brought with me. In this bench we aimed to thoroughly heat the supplementary air supply before it went into the combustion chamber among the gases from the furnace proper, and in doing so we compelled it to traverse on each side of the bench back and forth five times between the waste heat flues. We also heat the primary air supply by compelling it to pass to the back end of the bench, and to come forward and discharge immediately under the grate bars. We also utilize the waste heat still further by passing it under the ashpan, and evaporating water so as to keep down the intensity of the heat in the coke chamber. The results of our experiments with that bench I will give you. A few days since, with the object of giving you these results, I made experiments extending over seven days in order to determine just how much coke we had left from each ton of coal. We are using 18 retorts, charging 9 retorts every two hours. The coal for the 9 retorts was brought in on one car, weighed, three retorts charged, and the coal remaining in the car was again weighed. The charges were run four hours, and the cal-

culation is made for 18 charges each day. On the 2d of October we used 6,140 pounds of coal, averaging 341 pounds to the charge, and saved 92 bushels of coke—which would be a saving of 33.43 bushels per ton. The results obtained on the succeeding days were very much like that, the charges varying somewhat, and being respectively 341, 343, 331, 323, 328, 327, and 320 pounds per charge. We made the experiments in this way so that we could determine, not the results for one day, but the results for seven days, as compared with each other, so as to see if there was any great discrepancy in the amount of fuel used one day as against another. We found that the bushels of coke saved each day per ton from that amount of coal were: 33.43, 32.15, 33.24, 31.52, 32,42, 32,77, 32.22. Of course we could only measure the coke which was saved; but we had made a previous measurement of 2,240 pounds of coal (which was a mixture of Youghiogheny and Kanawha piled together, so that it was impossible to determine the proportion of each), and found that the average was 40 bushels of coke to the ton. That would make the consumption of coke to the ton of coal carbonized as follows: 6.57, 7.85, 6.76, 8.48, 7.58, 7.23, 7.78 bushels, or an average of 7.42 bushels. The percentages of coke used, estimating 40 bushels to the ton, were: 16.36, 19.18, 16.98, 21.15, 18.87, 18.10, 19.42, or an average of 18.58. That was by measure. The measure used was the standard measure adopted by the New England Association. This was a two-bushel measure, of standard capacity, and one of a number which were all made at one place, and distributed to the members of the Association for the purpose of securing uniformity in the comparison of results of experiments.

Mr. S. G. Stiness—Did you take the weight also?

Mr. Stedman—Not in this experiment. In the experiments which the Boston Guild ordered its members to make, an effort was made to determine the amount of coke made per ton, and the weight of coke made per ton was determined by weighing the hot coke, in order that all the coke should be weighed under similar circumstances. The average result, so

far as obtained and reported, was 35 pounds to the bushel of Youghiogheny and Westmoreland coal.

The charges through the three months were: In July, 305 pounds per retort; in August, 309 pounds; in September, 339 pounds. The retorts are 14 by 26 by 9. In October, to the 15th inst. the average charges have been 309 pounds. We obtained in this bench what we did not in the other—the ability to run almost any heats, and any charges that we could get into the retorts. In the other experiments, which we commenced a year ago, we could never run the charges over 300 pounds steadily, and generally not much over 200 pounds. We have never used supplementary bars at all in this bench. The grates are shaken generally just before a charge is drawn from the lower retort into the furnace. Occasionally a bar is run in from below to loosen up the coke and to break up any masses which have run together. About once in twelve hours the fire has a thorough stirring up from below. Since first firing, on June 30, the furnace has been cleared out on the 17th and 25th of July, on the 3d, 14th, 20th, and 29th of August, and on the 3d, 9th, and 29th of September; and not at all since the last date. It seems as if, with lower heats and less draught, clinkers are scarcely formed at all. At no other times than on the above dates have the bars been drawn out; and all that has come from the furnace has been shaken out between the bars by gently agitating them with a lever made for the purpose. The average velocity of the air in September, at the primary air ports, was 400 feet per minute. The average area of openings to supply the air was 2¼ x 4½ inches, and there were two openings. A calculation will show that this supply was hardly sufficient to burn the amount of coke actually consumed in the furnace; and the probability is that the balance of the air was obtained through obscure leaks around the ashpit door. At the supplementary air ports the velocity was 1,100 feet per minute, and there were two openings of 2 x 4½ inches. We have a chimney 80 feet high; and I doubt whether the stacks on top of the ordinary bench would be sufficient to give the draught necessary to run this bench. The pull on the main flue represented .42 inches

vacuum; and the secondary air flue, .17 inches; and on the primary air flue, .075 inches vacuum. The water evaporation was 80 pounds per hour—that being the mean of four tests.

It is quite possible that I may be wrong in some of these figures, but I have been careful to make them as thorough and reliable as possible; and you will not charge me with trying to lead you astray. I really believe that this furnace has done just what I have got down on paper; and it has given us great satisfaction. In the ease with which the furnace is run there has been a great gain and saving in labor; and there has been a large saving in fuel used in getting the degree of heat required. Another thing which I might menton is that, so far as as I have been able to observe, when the furnace is cleaned out the bricks are as square cut on their edges and corners as they were when they were first laid in the furnace. They do not seem to be eaten away at all. I do not suppose that there was, at any point in the furnance, an intensity of heat sufficient to fuse the face of the bricks at all.

THE PRESIDENT—What is the expense of the bench as compared with the ordinary setting?

MR. STEDMAN—I omitted to determine that exactly, but I should suppose that the additional expense would be somewhere between $150 and $175. Of course, the excavation in the first place (if that is taken into consideration) is quite an item. We excavated below the floor line of the retorts just six feet, so that we have a cellar underneath the floor which is six feet deep. The floor is supported by iron beams. The flues are built up about 10½ inches high, one above the other; and the waste gas flues and air flues are separated from each other by tiles. After that expense has once been made, I cannot see why the lower part of the furnace should not outlast quite a number of settings of retorts.

MR. BATTIN—The ashpan, as I understand you, is set near the bottom of the excavation, and the waste heat is made to run under that before going into the chimney.

MR. STEDMAN—Yes.

THE PRESIDENT—Were these furnaces built under existing ovens of yours?

Mr. Stedman—They were.

Mr. Battin—Do you set the regenerator under the oven, or do you put it in front?

Mr. Stedman—After the setting was taken out we cut six feet straight down. The face of all the work below the floor line is in the same vertical plane as the face of the retort work above; so that the furnace and all the air-heating arrangements are directly below the retort, and the furnace does not project out in the slightest degree into the cellar way. The earth underneath our furnace admitted of that cutting down. It was very heavy clay, and we had no difficulty in cutting right square down, and then cutting out underneath the walls at intervals, and building up with brick until we caught the arches, and then excavating the other dirt and fillng in with brick.

The President—Do you bring the waste heat down through the regenerator flues below the retort by the draught of your chimneys?

Mr. Stedman—Yes, sir. The waste heat on the right hand side goes in back under the retort, and passes to the front; then it goes down past the position occupied by the first supplementary air flues, and returns to the rear of the bench; then it dives down again past the next air-heating flues, comes forward, and on that same plane goes back again to the back end; then it dives down again, comes forward to the front end of the bench, passes underneath the ashpan, and goes out on the other side of the bench. The waste gas on the left hand side follows the same course, except that, on reaching the lower flue, it passes underneath the front half of the ashpan, while the waste heat from the other side passes underneath the back half of the ashpan; so that just before it leaves the bench, in each case, the waste heat comes in contact with the bottom of the ashpan, and produces heat enough to evaporate the amount of water required.

The President—What are the recuperatory flues made of?

Mr. Stedman—The upper flues, which are subjected to the most intense heat, are made of clay tubes, in sections about two feet long, with three or four partitions in them; and these par-

titions are set against each other with dovetails, and when set together they are packed in with clay. The covers of the air flues are made of two thicknesses of tile, each tile 1⅛ inches thick; and between these two tiles is a layer of No. 20 plate iron, from front to rear. We built the two flues on each side, and then covered them with tiles from front to rear 1⅛ inches thick, and on these tiles are embedded in clay the plate iron, and the upper layer of tiles goes on to that iron We supposed that the iron, being protected in that way from the action of the hot air, would last a long time, notwithstanding the high heat; and we found that to be the case. Although we have run the bench with very high heats, we found no leakage of the air from the air flues into any passage where it ought not to go.

The President—Have you tried the heats of the escaping products?

Mr. Stedman—I have not tried the heats of any part of the apparatus. The heat is, of course, very much reduced before it goes off into the main flue.

The President—It seems to me that you have secured about as perfect a regenerator as any one.

Mr. Stedman—I think the results are quite satisfactory; but I think I can save about 1½ bushels per ton next time. I may be over sanguine on the subject just now.

Mr. Vanderpool—Have you let this bench down, to see if there is any leakage in the recuperating flues?

Mr. Stedman—No; I had rather not do that until we need to let it down. I think the probability is that it would break or crack somewhere. But still I do not think the breaks would be serious. In our first regenerator we simply covered the air flues with a single thickness of tile; and when one of these cracked the aperture let the hot air escape. With the tiles as now placed, the probability is against their cracking directly over each other, although the strain might come in one place over two tiles so that they would break; and in such a case I think the air would make a passage clear through. In the old bench we found that wherever we used iron at all,

the iron would oxidize very rapidly where it was exposed to the hot air.

MR. VANDERPOOL—What is the number of square feet in your recuperator?

MR. STEDMAN—I cannot tell.

MR. VANDERPOOL—Did you charge with hot or with cold coke?

MR. STEDMAN—I draw such portion of the coke as is needed, every two hours, from the bottom retort, directly into the furnace.

MR. VANDERPOOL—What depth of coke do you use?

MR. STEDMAN—We generally have it 4½ feet deep. The furnace is 20 inches wide by 3½ feet long.

MR. VANDERPOOL—Do you only go down six feet from the level of the floor to the bottom of the furnace? Does the six feet include the furnace, foundation and all?

MR. STEDMAN—It includes the furnace, ashpan, and the space underneath the ashpan for the waste gas flues.

MR. VANDERPOOL—Is it a single or double bench?

MR. STEDMAN– It is a stack of single benches. The retorts are 9 feet deep; we call it a 9-feet retort; they are 8 feet 8 inches inside.

MR. STARR—At what point do you introduce the fuel into the furnace?

MR. STEDMAN—Through the ordinary fire door just above the floor line of the retort house.

MR STARR—Is that done by shooting?

MR. STEDMAN—We have a chute made which wheels up underneath the lower retort, and is made on an incline, so that, as the coke is drawn out of the lower retort, it falls down in the direction of and in front of the feed door; a man stands there with a flat-headed rake, and pushes the coke in and distributes it around the surface of the furnace.

MR. STARR—Is the opening at the top about on a level with the bottom of the retorts?

Mr. Stedman—The bottom of the retort, if I remember rightly, is 19 inches above the floor line; the opening of the door is 14 inches; and, adding 2 inches for the lower part of the frame, the top of the opening would be about 16 inches. The bottom of the opening is within 2 inches of the floor, and consequently would be about 17 inches below the retort.

Mr. Starr—How deep do you fill with coke?

Mr. Stedman—We fill up just about to a level with the floor of the retort house. It is pushed in so that it is just below the frame of the door.

Mr. Starr—And then you say that you bring the heat, after it goes over the bench, down on the back of the lower retort, and then it comes front and goes below, and goes back again, and comes to the front again?

Mr. Stedman—Yes; it comes back to the front, and then back again, and then to the front and underneath the bottom of the ashpan, and then again on the other side, and out.

The President—Do you find the heat which you get at the ashpan sufficient to give you all the steam you need to keep the clinker down?

Mr. Stedman—No, sir; when using the largest quantity of coal we might advantageously use more steam. The incandescence in the body of the coke itself is somewhat greater than it should be, according to all the accepted theories on the subject.

The President—Schilling produces his steam by the use of waste heat in the same way.

Mr. Stedman—Of course, that is an economical way to produce it.

Mr. Allyn—Have you stated about what the yield was in using this quantity of fuel to carbonize that quantity of coal?

Mr. Stedman—We had no way of determining the yield from that bench alone; but the yields while running that bench were as follows: In July, 4.95; August, 4 99; September, 4.98. I have not got it for October.

Mr. Allyn—What was the candle power?

MR. STEDMAN—The candle power for the time averaged about 17½.

M. ALLYN—By what standard was that tested?

MR. STEDMAN—It was tested by a jet photometer. We could not very well use the bar photometer, because its use requires more time and science than we can command.

MR. C. NETTLETON—Supposing that any of the other gentlemen here wanted to make benches of that sort, I would ask whether Mr. Stedman would furnish drawings, and charge for the drawings, or whether there is a tariff to be charged in addition to that. Suppose that any gentleman is willing to buy it for himself, how much would he have to pay?

MR. STEDMAN—I am unable to say as to that at present.

MR. C. H. NETTLETON—What percentage of the 40 pounds of coke is sufficient to carbonize 100 pounds of coal? I presume it is about 12 pounds, is it not?

MR. STEDMAN—I presume so, but I have not figured it in that way.

MR. C. H. NETTLETON—It seems to me from the remarks made that we hardly appreciate what good figures have been shown us here. So far as I have noticed the proceedings in foreign associations this result has never been equalled. The best that I have seen of the foreign workings (and I think we all admit that they are far ahead of us in the use of regenerator furnaces) is that they are able to carbonize 100 pounds of coal with 15 or 16 pounds of coke. Mr. Stedman says that, in a week's work, he has been able to do that with about 12 pounds.

THE PRESIDENT—Dr. Schilling claims 11 pounds in his last results.

Mr. C. H. NETTLETON—But that is with eight retorts. The point I wish to make is that Mr. Stedman has been able with six retorts to accomplish nearly as good results as Dr. Schilling, and better than anybody else has been able to do. So that it brings the most economical method of carbonizing coal within the reach of the smallest of our works. I am very glad

that Mr. Stedman has been able to succeed so well. I think it is a fact that we all have reason to be proud of, that a member of the Association has obtained such satisfactory results.

Mr. Vanderpool—I do not think there ought to be any mistake about what Dr. Schilling has done. I have a memorandum here of the working of his furnace, which I will refer to. By the generator furnace and recuperator designed by Dr. Schilling, the following results have been obtained at Munich:

Yield of gas per setting in 24 hours .	81,200 cubic feet.
Coal carbonized	16,170 pounds.
Consumption of coke	1,760 pounds.
" "	47.44 bushels.
Percentage of ash in coke	14
Yield of gas per mouthpiece in 24 hours	10,150 cubic feet.

Four-hour charges. Setting of 8 retorts—7 ovals, 20½ in. by 15 in. by 9 ft. 9 in., and one round retort, 16 in. in diameter.

Yield of gas per ton	10,940 cubic feet.
Weight of charge	336 pounds.
Consumption of coke as fuel—per cent. of coal carbonized	10.9

If we should take our standard caking coals and work as above we should obtain—

Coke made per ton of coal	42 bushels.
Weight of coke per bushel	37.1 pounds.
Coke made per setting in 24 hours .	302.82 bushels.
Coke used as fuel	47.44 bushels.
Coke left for sale per ton.	35.4 bushels.

The President—I think Mr. Stedman's figures compare very favorably with those of Dr. Schilling.

Mr. Vanderpool—Very favorably, indeed. I think it is quite remarkable that he should have produced such very satisfactory results.

Mr. Isaac Battin—I think the hearty thanks of the Association are due to Mr. Stedman; and I move a vote of thanks.

The motion was unanimously carried.

MR. STEDMAN—I am very grateful for your appreciation. I wish to say that I always dislike to present figures like these. Perhaps you will not credit a New Englander with so much modesty, for I admit that it does sound like boasting; but I present them in the interest of a common cause, and, as you might say, against the common enemy. (Applause.) If you will reflect for a moment you will see that the residuals ought to pay about the cost of the coal. If you only reckon 40 bushels of coke (and the recent experiments of the Boston gas managers show that their average is about 42 to 43 bushels from Youghiogheny and Penn coals) at 8 cents per bushel, you get $3.20; you get 15 gallons of tar at 4 cents; and the ammonia whenever we make it worth our while to handle it, will certainly net us 60 cents per ton. I am sure that I am not wild in that figuring. Add those together, and see how near you come to paying for the original coal, if you pay about $4.50 per ton for it. And if you can spare out of your coke as small a number of bushels as possible, and have as large a remainder as possible left, you come pretty near to paying for your original coal. And, by-and-by, by the aid of some scientific process (which will be made simple to us, perhaps, although pretty abstruse now), we may get to the point of getting our gas for considerably less than nothing. (Applause.)

MR. FULLAGER—During the time that you were running that bench, did you not find any depreciation in your ammoniacal liquor?

MR. STEDMAN—I did not try it during that time.

THE PRESIDENT—Have you, Mr. Fullager, found such results?

MR. FULLAGER—I found last winter and summer that our ammoniacal liquor fell so low that the ammonia man didn't want to touch it. We got less per ton of coal, and it was very weak. We found so much salt in the hydraulic main that we could cut it out in chunks. We removed the pure salts from the main.

The President—That saves distillation.

Mr. Fullager—Yes; it does save distillation. (Laughter.) When we started the regenerator bench last September we had forty in use, and will have eighty at the close of the season. The first stoppage that we had was in the main. I sent men up to see what was the matter, and they would cut it out in square chunks. It was a mixture of tar and ammonia. We could take it out and break it up just as we would the sulphate. The ammonia man complained that we were giving him no strength. The next trouble was with stopped pipes. We got over that when we went back to the four-hour charges. But instead of getting the 10-ounce liquor we can get it but 7 ounces. That is the best we can get while running those benches. The ammonia is in the shape of crystals mixed with tar. There is no pitch in it. It is almost like the sulphate, only it is in square chunks. You might almost think from the appearance that it was sal-ammoniac. The Professor analyzed it, and said that it was almost pure ammonia. If you put lime with it, it will give off sulphate fumes. Another queer thing about it was that our purification with the sponge increased right off. It ran from 5,000 to 6,000 feet per bushel during the whole month. The heat was most intense during that time. Since the heat has been brought down we have got rid of it. That was while we were having trouble with the pipes, and were foolish enough to try three-hour charges. We were using part Kanawha and part Youghiogheny coal at that time.

Mr. Cabot—For the last month, the parties to whom we have sold ammonia water have complained. We have been running high heats. They have compained that the strength of the ammonia water was so much reduced that they could not use it.

Mr. Hyde—During the last month or two, at the Cleveland works, for some reason or other, the ammonia water is weak, and we do not know what the trouble is. What the gentlemen say on the subject is new to me. I have not yet been able to find out what the cause is.

THE PRESIDENT—Have you used the same quantity of water in the scrubber?

MR. HYDE—Yes, just the same. I made a little change in the condensation, and they have taken off part of the condensation pipes.

MR. C. H. NETTLETON—Has not the President had some experience with his furnace, which he will give to the Assotion?

THE PRESIDENT—Nothing but what has already been made the most of. We are just now preparing to fire up a new stack of eighteen benches in Chicago. They are being warmed up now; and as soon as I get back we will charge them, and may give you some figures at the next meeting.

The Association then adjourned to meet on Thursday, October 18, 1883, at 10 A. M.

MORNING SESSION—OCTOBER 18.

MR. STINESS (Chairman of the Committee on the place of holding the next meeting)—I am directed by the committee upon the selection of the place for holding the next annual meeting of the American Gas Light Association, to report that they are unanimously in favor of the city of Washington, D. C. I may be permitted to say, in this connection, that while there are many reasons which have guided them in their selection of the city of Washington, there is an additional reason, that one who was for many years, in the true sense of the word, an active member of the Association, resides in Washington; but who, by the dispensation of Divine Providence, may never be permitted to meet again with us unless the Association should hold its meeting in his own immediate vicinity; and the committee feel that while it would be a pleasure to have the Association meet in the city of Washington, it would also be a merited compliment to one who has adorned his profession as few other men in this country have done. Therefore, and for those reasons, the committee were unanimous in the selection of the city of Washington as the

place for holding the next annual meeting. And it is most earnestly hoped that some member of this Association who is a personal friend of our distinguished frater, Mr. George A. McIlhenny, of Washington, will express to him the fact that it is the earnest desire of the Association that he will take no active part in any of the arrangements necessary to be made for the meeting, but will remain perfectly passive; and that the Association will esteem it as a privilege to them to meet with him, and to make the arrangements entirely outside of and beyond him. (Applause.)

On motion the report of the committee was unanimously adopted.

THE PRESIDENT—Mr. Goodwin will now favor us with a paper.

THE PROPER COMBUSTION OF GAS.

MR. GOODWIN—Having been asked to say something in the interest of gas consumption, it has occurred to me that I might make a few remarks connected with the subject of the proper combustion of gas for heating and cooking purposes, and the practical problem of the conversion of heat into mechanical work. I do not propose, however, to enter into a strictly scientific discussion of the subject, but rather to present a few facts connected with the question, and which cannot be ignored or passed over lightly if we desire to master the subject; viz, the means of obtaining the largest quantity of heat from gas.

We know, scientifically, that carburetted hydrogen and the other compounds of carbon require given quantities of atmospheric air to effect their combustion; yet it seems to me we neglect to adopt the means, practically, of ascertaining what quantities are supplied, and treat them as though no such portion was necessary. We know the proportions in which the atmospheric constituents are combined, yet we neglect the fact, and appear wholly indifferent to the distinct nature of their effects in combustion. We know that the inflammable gases are combustible only in proportion to the degree of mixture and union which is effected between them and the oxygen of the atmosphere, yet we neglect to examine or trouble our-

selves as to whether the necessary mixture has been effected or not. This should not be; more attention must be given to this subject, if we would realize the best attainable results. And this can only be accomplished by a sounder and more scientific knowledge of the question, to be only acquired by greater attention to the chemistry of the subject.

The main constituents of bituminous coal are carbon and hydrogen. In the natural state of coal these elements are united and solid. The leading distinction is that the bituminous portion is convertible to the purposes of heat in the gaseous form alone. The carbonaceous portion is combustible only in the solid state. Neither can be consumed while they remain united.

When the heat is applied to bituminous coal it absorbs it, gas being generated, the carbonaceous or coke part remaining behind. I now propose to show, in as brief a manner as I can, the processes incident to the proper combustion of the gaseous portion of the coal.

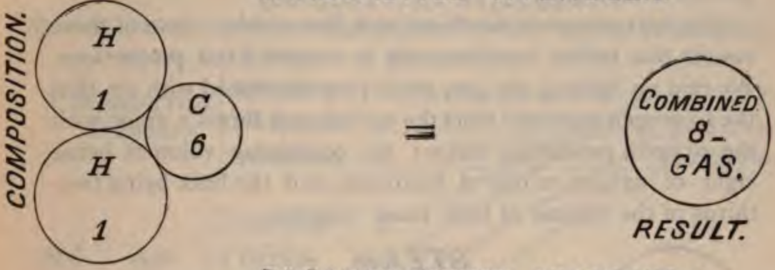
Among the results of the application of heat to the coal in the retorts is carburetted and bi-carburetted hydrogen, or olefiant gas, these being known as combustible gases. In order to consume them there must be a supporter, and which we call oxygen; in order to effect combustion, there must be a chemical union of these gases. Coal gas, not being inflammable of itself, cannot produce flame nor cause the continuance of flame in other bodies.

The first step, therefore, is to ascertain the quantity of oxygen with which these gases will chemically combine, and the quantity of air required for supplying such measure of oxygen. An atom of hydrogen is double the volume of an atom of carbon vapor, yet carbon is six times the weight of hydrogen; an atom of hydrogen is double the bulk of an atom of oxygen, yet the latter is eight times heavier than the former. Of the constituents of atmospheric air—nitrogen and oxygen—the volume of the former is double the volume of the latter, yet in weight, it is 14 to 8.

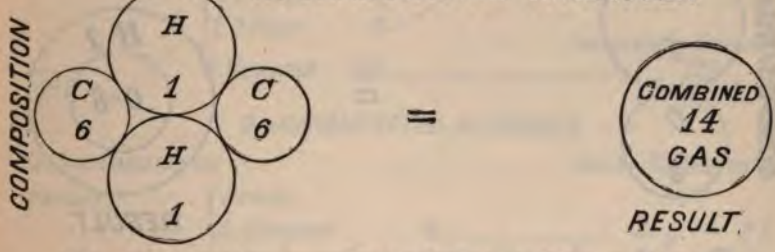
If we represent the atoms of these gases by diagrams, it will

help to illustrate the subject. Carburetted hydrogen consists of two volumes of hydrogen and one carbon vapor, the gross bulk of these 3 atoms being condensed into the volume of a single atom of hydrogen, or two-fifths of their previous bulk.

CARBURETTED HYDROGEN.



BI-CARBURETTED HYDROGEN



Here we have bi-carburetted hydrogen, which consists of two volumes of hydrogen and two volumes of carbon.

The air being composed of two atoms of nitrogen and one atom of oxygen—each of the former being double the volume of one of the latter—the gross volume of the nitrogen will be four times that of the oxygen, and, in weight, 28 to 8; thus—

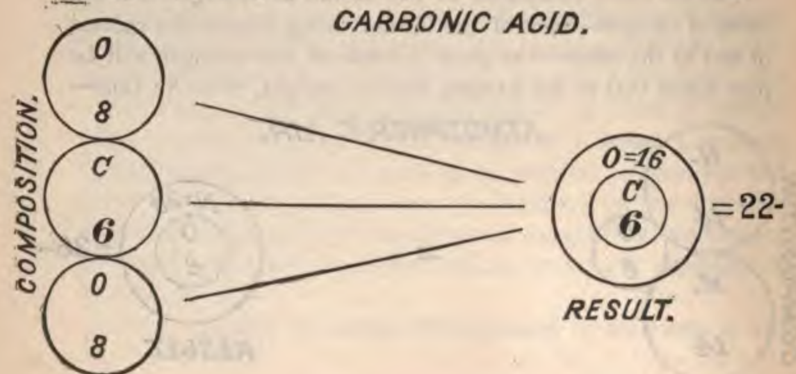
ATMOSPHERIC AIR.

As the constituents of air are not condensed, we consequently find that, in volume, we have 80 per cent, of nitrogen and 20 per cent. of oxygen.

Our next step is to ascertain the separate quantity of oxygen required by each of the constituents of the gas in order to effect perfect combustion.

The laws of nature are fixed and immutable. One of these laws is that bodies combine only in certain fixed proportions. We find on lighting the gas, when properly mixed with air, that the hydrogen separates from the carbon and forms a union with the oxygen, producing steam; the combining volumes being eight of oxygen to one of hydrogen, and the bulk being two-thirds of the volume of both taken together.

The carbon, on meeting its equivalent of oxygen, unites with it, forming carbonic acid gas—viz., 1 atom of carbon and two of oxygen (by weight, $O_{16} + C_6$).



Thus is proved the fact that one atom of hydrogen and one atom of oxygen (the former being double the volume of the latter) unite to form water, and one atom of carbon and two of oxygen (the latter being double the volume of the former) unite to form carbonic acid.

CARBURETTED HYDROGEN

Before Combustion. Weight		Elementary Mixture. Atoms	Weight	After Combustion. Weight
8 Carburetted Hydrogen		1 Carbon	6	22 = CO_2
		1 Hydrogen	1	9 = Steam
		1 Hydrogen	1	9 = Steam
144	Air	1 Oxygen	8	
		1 Oxygen	8	
		1 Oxygen	8	
		1 Oxygen	8	
		8 Nitrogen	112	Uncombined Nitrogen 112
152				152

BI-CARBURETTED HYDROGEN.

Before Combustion. Weight	Atoms		After Combustion.
14 Bi-Carburetted Hydrogen	1 Carbon	6	CO_2 = 22
	1 Carbon	6	CO_2 = 22
	1 Hydrogen	1	Steam = 9
	1 Hydrogen	1	Steam = 9
216 Atmospheric Air	1 Oxygen	8	
	1 Oxygen	8	
	1 Oxygen	8	
	1 Oxygen	8	
	1 Oxygen	8	
	1 Oxygen	8	
	12 Nitrogen	168	Uncombined Nitrogen - 168
230			230

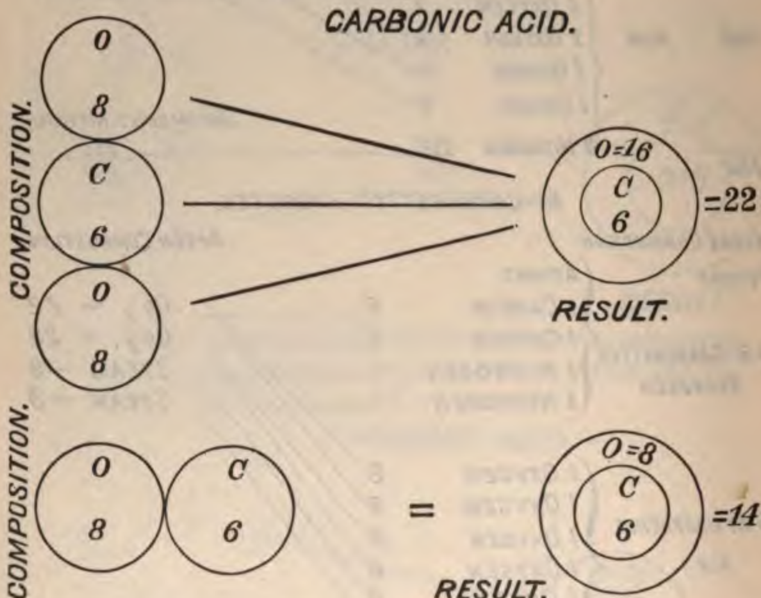
The next question to be decided is the quantity of air required to supply this quantity of oxygen. As the atmosphere

contains but one-fifth in volume of oxygen, five volumes of air will be required to produce one volume of oxygen ; and, as two volumes of oxygen are required for each volume of the coal gas, we must provide ten volumes of air.

The proportion of air for the combustion of bi-carburetted hydrogen, or olefiant gas, is necessarily larger than for the carburetted hydrogen.

Carbon is susceptible of uniting with oxygen in two proportions, by which two distinct bodies are formed—viz., carbonic acid and carbonic oxide.

Carbonic oxide contains but one-half the quantity of oxygen yet its bulk is the same as carbonic acid; thus—



If a sufficient quantity of air is not secured to resolve the entire quantity of gas into steam and carbonic acid, carbonic oxide will be a part of the product of combustion, and the result will be detrimental to a proper combustion of gas for heating and cooking, as well as for mechanical purposes ; whereas, if we can

attain a perfect combustion or chemical union, the best possible results will be attained.

To this end the gas stove manufacturers and gas engine builders must turn their attention if they desire to accomplish this most desirable result. In determining which mode is the best for consuming gas for heating and cooking, as well as for mechanical purposes, there must be a standard, as there is in determining the candle power or correct registration of gas consumed. This standard is called the unit of heat, and is the amount of heat required to raise the temperature of one pound of water (at 32 degrees) one degree Fahrenheit.

It has been found that to produce a unit of heat requires 772 foot pounds, or 772 pounds falling one foot ; this is termed the mechanical equivalent of heat; consequently one unit of heat should be capable of doing 772 foot pounds of work.

It has been determined, by careful experiment, that one cubic foot of coal gas can develop 696 heat units. Adopting this figure as the standard, the efficiency of the different forms of gas stoves, and the various kinds of burners used for purposes of heating and cooking can be determined, and the question settled as to the best form of burner for roasting, broiling and oven purposes.

Gas Engines.

With reference to the most efficient manner of using gas for mechanical purposes, or the production of power as developed by the use of gas engines, it seems to be a well-settled fact that the only correct mode is by compressing the gas before ignition.

Mr. Dugald Clerk recently prepared and read a paper before the Institution of Civil Engineers, of England, which has been thought of sufficient merit to be noticed by the War Department of the United States in Ordinance Notes, No. 230, October 21, 1882.

In the paper referred to Mr. Clerk discusses the merits of three types of gas engines. The first type is an engine drawing into its cylinder gas and air at atmospheric pressure for a portion of the stroke, cutting off communication with the outer

atmosphere, and immediately igniting the mixture, the piston being pushed forward by the pressure of the ignited gases during the remainder of its stroke. The in-stroke discharges the products of combustion. This type is illustrated by the Bisschop, Turner, Sombart (which is a copy of Bisschop's) and other engines of like character. In a recent trial I found a 1-man power Bisschop engine required 18 cubic feet of gas to develop that power—equal to about 90 feet per horse power.

The third type of engine is one in which a mixture of gas and air is compressed, or introduced under compresion, into a cylinder, or space at the end of a cylinder, and then ignited while the volume remains constant and the pressure rises. Under this pressure the piston moves forward, and the return stroke discharges the exhaust. Types one and three are explosive engines, the volume of the mixture remaining constant while the pressure increases.

Mr. Clerk, in the course of his experiments, has found that 1,537° C. (2,766° F.) is the temperature usually attained by the ignited gases of his engines, and accordingly has investigated the behavior of air under different conditions at this temperature.

Mr. Clerk asks: "Suppose an engine to have a piston area of 144 square inches, and a stroke of two feet, let the piston move through half of its stroke, drawing into the cylinder air; let enough heat be immediately added to this air to cause it to rise instantly to 1,537° C., and the piston moving forward under the pressure produced, if there be no loss of heat through the cold sides of the cylinder, but the temperature of the air fall only through performing work, how much work would be done when the piston completes its out-stroke?"

The following are the results, as stated by Mr. Clerk:

1 cubic foot of air remaining at constant volume requires, to heat it to 1,537° C., an amount of heat equivalent to . .	26,762 foot pounds.
Maximum pressure, in pounds, per square inch above the atmosphere	76.6 pounds.

Pressure at end of stroke per square inch above the atmosphere	19.6 pounds.
Mean pressure during available part of stroke . . .	39.8 pounds.
Temperature of air at end of stroke	1,089° C.
Work done on piston . .	5,731 foot pounds.

$$\text{Duty of engine,} \frac{5{,}731}{26{,}762.} = 0.21.$$

As the engine is supposed to draw in air for half of its stroke, the last half of the stroke only is utilized for power; the mean available pressure, calculated for the whole stroke is only

$$\frac{39.8}{2} = 19.9 \text{ per square inch.}$$

Type three.—Suppose an engine to draw into a pump one cubic foot of air; on its return stroke force into a reservoir 40 pounds above the atmosphere; the motor piston is now at the beginning of its out-stroke, and as it moves forward air from the reservoir enters the cylinder, while the piston sweeps through 0.39 cubic feet. At this point communication is cut off, and the temperature suddenly raised to 1,527°C. Hitherto the air has remained at the temperature of compression—150½°. The pressure goes straight up to 230 pounds above the atmosphere. The piston continues to move forward, and the air expands doing work. At the end of the stroke the pressure has fallen to 8.4 pounds per square inch above the atmosphere.

The following are the results:

1 cubic foot of air at constant volume requires, to heat it from the temperature of compression (150°½°) to 1,537° C., heat equivalent to . . .	24,416 foot pounds.

Maximum pressure, in pounds per square inch above atmosphere	220 pounds.
Pressure at the end of stroke .	8.4 pounds.
Mean pressure during available part of stroke . . .	47.8 pounds.
Temperature at middle of stroke	953° C.
Temperature at end of stroke .	648° C.
Work done on the piston .	11,090 foot pounds

$$\text{Duty of engine, } \frac{11{,}090}{24{,}416} = 0.45.$$

In the most important modification of this type of engine, instead of a separate reservoir, a space is left at the end of the cylinder, into which the piston does not enter; and in this space the gases forming the inflammable mixture are compressed. The rise in pressure, therefore, commences at the beginning of the stroke, instead of when the piston has traveled out.

Comparing the results from the three modes, under precisely similar conditions, the same weight of air heated to the same degree, and used in cylinders of identical capacity, there is considerable difference in the results possible, even under the purely theoretical conditions stated. The relative work obtained from one cubic foot of air heated to the assumed temperature is as follows:

Type 1.— 5,731	foot pounds	work	obtained	= 0.21	duty.
" 2.—11,759	"	"	"	= 0.36	"
" 3.—11,090	"	"	"	= 0.45	"

I have omitted type 2, in which the maximum pressure in pounds per square inch above atmosphere was 76.6. The work done on piston was 11,759 foot pounds, which, divided by 32,723 foot pounds, gives the duty of 0.36.

The result is that in an engine of type one, if 100 heat units be used, 21 units will be converted into mechanical work; in type 2, with the same amount of heat, 36 units will be given as work; and in type 3, no less that 45 units would be converted into work.

The great advantage of compression over no compression is clearly seen by the simple operation of compressing before heating. The last type of engine gives, for the same expenditure of heat, 2.1 times as much more work as the first. Compression as used by the second type does not afford so favorable a result; but even then the advantage is apparent, 1.6 times the effect being produced. By a greater degree of compression before heating, even better results are possible. What compression does is to enable a great fall of temperature to be obtained due to work done with but a small movement of the piston. In type 1, when the piston has reached the end of its stroke, the increase from the moment of ignition is only from 1 volume to 2 volumes, while in type 3, with the same total volume swept by the piston, it increases from 1 to 5 volumes. In the one case the ratio of expansion is 2, while in the other it is 5. In type 1 the mean available pressure over the whole stroke is nearly 20 pounds per square inch. The compression in the Clerk engine is at least 40 pounds per square inch above, the atmosphere.

Mr. Clerk (from whose paper I am quoting largely) states that, taking all circumstances into consideration, it is certainly not overestimating the relative advantage of the compression engine to say that it will, under practical conditions, give, for a certain amount of heat, three times the work it is possible to get from the engine under no compression.

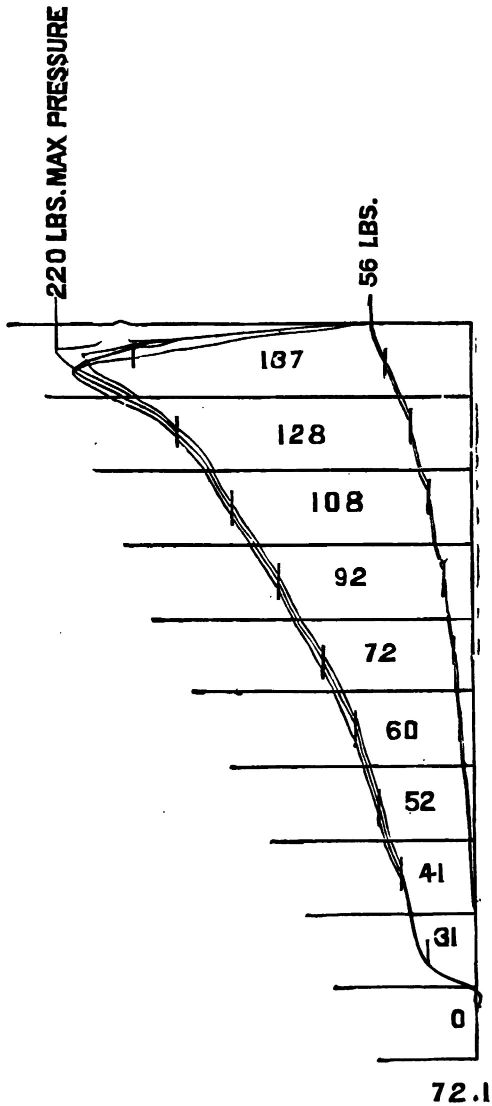
The amount of gas consumed by the three types of engines hitherto in practice is about as follows:

Type 1.—95 cubic feet per indicated horse power per hour.

Type 2.—(Brayton) 50 cubic feet per indicated horse power per hour.

Type 3.—22 cubic feet per indicated horse power per hour.

The accompanying figure represents a diagram from one of the Clerk engines, which belongs to type 3. Indicated horse power, 12¾; average pressure, 72 pounds; maximum pressure, 220 pounds; pressure before ignition, 56 pounds; revolutions, 154; diameter of cylinder, 7 inches; length of stroke 12 inches; consumption of gas, 20.7 cubic feet per indicated horse power per hour.


220 LBS. MAX PRESSURE
56 LBS.
137
128
108
92
72
60
52
41
31
0
72.1

In order to obtain the best results in the shape of mechanical work from a gas engine, it is very important that the mixture of gas and air should be in proper proportion. In exploding different mixtures of marsh gas and air, the following results have been obtained :

Marsh gas 1 volume, air 5 volumes.—Passing the electric spark through the mixture, no effect is produced.

Marsh gas 1 volume, air 6 volumes.—Explosion only occurs in a succession of shocks ; this is the first limit of possible explosion, marsh gas being in excess.

Marsh gas 1 volume, and 7, 8 and 9 volumes of air, gave a sharp explosion ; with 12, 13, 14 and 15 volumes of air for 1 volume of marsh gas, explosion occurs, but grows gradually weaker ; with 16 volumes of air, the effect is reduced to a series of slight intermittent commotions. This is the second limit ; the air is in excess.

In the Clerk engine, calculating from the moment when the ignition port is opening to the flame to the moment of maximum pressure as represented in the diagram, it has been ascertained that the time occupied is an average of 1-25th of a second. The time taken to attain maximum pressure is longer in a large engine than in a small one, because the distance through which the flame has to travel is greater. Professor Bunsen, during a series of tests to determine the celerity of the propagation of ignition through a pure explosive mixture of hydrogen and oxygen, found the rate of the propagation to be 34 meters per second, or about 110 feet. In a maximum explosive mixture of carbonic oxide and oxygen, it was not quite 1 meter, or 39 inches per second. It was been found that the maximum rate of propagation of ignition through a mixture of 1 volume of coal gas with 5 volumes of air to be 1.01 meter per second. One volume of coal gas with 6½ volumes of air gave a rate of 0.285 meters, or 11 inches, per second. This is the rate of ignition at constant pressure ; in a closed tube fired at one end it would ignite with much greater rapidity.

Mr. Clerk found it possible to ignite a whole mass in any given time between the limits of 1-10th and 1-100th part of a second by so arranging the plan of ignition that a small volume

of gaseous mixture is first ignited, expanding and projecting a flame through a passage into the mass of inflammable mixture, and thus adding to the rate of ignition the mechanical disturbance produced by the entering flame. He has succeeded by this means in producing maximum pressure in 1-100th part of a second in a space containing 200 cubic inches. This rate of ignition, however, is too rapid, and would not give the engine time to take up the slack in bearings, connecting rods, etc.; but by firing a mixture with varying amounts of mechanical disturbance, almost any time of ignition can be obtained between 1-100th and 1-10th of a second. It does not matter whether the mixture used is rich or weak gas; the rich mixture can be fired slowly and the weak one rapidly, just as may be required. The rate of ignition of the strongest possible mixture is so slow that the time of attaining complete inflammation depends upon the amount of mechanical disturbance permitted.

It will be seen from the foregoing that without compression before ignition an engine cannot be produced giving power economically and with small bulk. The mixture used may be diluted, air may be introduced in front of gas and air, or an elaborate system of stratification may be adopted, but without compression no good effect will be produced. This is the great advance over the old system; the greater the compression before ignition the more rapid will be the transformation of heat into work by a given movement of the piston after ignition. The greatest loss in the gas engine is that of heat through the sides of the cylinder; and this is not astonishing when the high temperature of the flame in the cylinder is considered. In larger engines using greater compression and greater expansion it will be much reduced. As an engine increases in size the volume of gaseous mixture used increases as the cube, while the surface exposed only increases as the square, so that the proportion of volume of gaseous mixture used to surface cooling is less the larger the engine becomes.

Mr. Clerk states that, taking these facts into consideration, it may be accepted as probable that an engine of about 50 indicated horse power could be made to work on 12 cubic feet of coal gas per indicated horse power per hour, or a duty of about

32 per cent. The gas engine is yet in its infancy, but it can and will be made as manageable as the steam engine in by no means a remote future. The time will come when factories, railways, and even ships, will be driven by gas engines as efficient as by any steam engine, and much more safe and economical of fuel. Gas generators will replace steam boilers, and power will not be stored up in enormous reservoirs, but be generated direct from the coal required by the engine.

Mr. President, in thanking the Association (which I now do) for their kind attention in listening to my remarks, I have to say that when I commenced the preparation of this paper I had no idea of extending it to its present length; but when I came to consider the question of the proper combustion of gas for mechanical work as developed by the gas engine, and as the subject was so new, I have been led to quote more largely from Mr. Clerk's paper on the theory of the gas engine than I at first intended. I again thank you for your kind attention.

DISCUSSION.

MR. M. S. GREENOUGH—We have listened with a good deal of interest to Mr. Goodwin's paper on the subject of the combustion of gases; but, of course, it is a paper which it is impossible for us to carry away in our heads. The value of it will be better appreciated, and it will be more valuable to us for the purposes of reference than it can be for discussion at the present time. A question, however, which interests us all is this matter of gas engines. There is one question, which I wish to ask Mr. Goodwin in that connection, and the question is perhaps more of a practical than of a theoretical nature. The only engine which I know of in use in this country to any extent is the Otto engine. I noticed Mr. Goodwin spoke of that as requiring 22½ feet of gas per hour per indicated horse power; and he says that the Clerk engine, of moderate power, requires 20.7 feet, or 10 per cent. less than the Otto engine. The people in our part of the country who have introduced the Otto engine have been very much pleased with the working of it; but they have found a great difficulty in its general introduction because of the im-

possibility of procuring them readily, and also because of the large cost. I wish to ask Mr. Goodwin whether there is any probability of the Clerk engine being introduced into this country within a reasonable time, and what will be the cost of the Clerk engine as compared with that of the Otto engine?

Mr. Goodwin—In order to answer that question I shall have to be again somewhat personal. I have endeavored, in my paper, to avoid all questions of business. It is a difficult matter for a man situated as I am in the business to avoid some reference to it. I had rather hoped that that question would not be asked me, as I did not want to make a public statement before the Association; but I think, under the circumstances in which the question is presented, the members will excuse me if I am compelled to bring in the shop in answering it. Several gentlemen, myself among the number, have acquired the right to manufacture the Clerk gas engine in this country, for which we paid a very large sum of money—amounting to tens of thousands of dollars in hard cash—before we commenced to do anything in the direction of manufacture. Two years ago last September, while in Paris, I came across this engine. I make this explanation by way of apology, because, a year ago, I promised to have the engines ready within three months. I then made an arrangement to get control of the manufacture of the engine in this country. Before we got a trial of the engine a year and four months passed, simply because of delay in consummating the arrangement. It became necessary, before the matter could be concluded, that Mr. Sterne should come to this country; and we found it necessary to come to long negotiations. As our English friends are sometimes slower than their Yankee brethren, we were greatly delayed in getting the matter satisfactorily arranged. After becoming possessed of the right to manufacture them, the question arose as to the best way to go about it. Such gentlemen as Mr. Merrick, and our lamented late President, Mr. Price, and two or three other gentlemen in this room, became interested with me in the company which has secured the right to introduce the engine into this country. The gentlemen who are here are so modest that I will not mention their names.

We went into this thing with the determination to get out an engine inside of three months. I will say to you that we spent tens of thousands of dollars to accomplish our purpose ; in fact, money was no object to us. We selected, out of several parties who were ready to take the manufacture of the machines, two of the largest establishments in this country, and we gave them a contract covering several hundred engines. These houses are first-class, one of them having at least $2,000,000 capital, and the other having more than that invested in their business. I state that fact to give you an idea of their capacity and ability to successfully carry out a contract of this kind. I have the pleasure of saying that you can see an engine in operation at the fair of the American Institute. We hope that within two months the Clerk gas engine will be ready to be furnished, to those who order it, by this company. With reference to the amount of gas consumed, I speak of this particular engine, No. 108, which uses an average of 20.71 feet of gas per hour per indicated horse power. That is one of the best cards we ever got from it, and I therefore show it to you. It shows what American skill may be able to accomplish. I do not wish to be understood as saying one unkind word against any other engine, and particularly against the engine in this country, of the third type, of which Mr. Greenough has spoken. The gentlemen who have introduced that engine deserve a vast deal of credit for their energy and efforts to produce a good engine. The difference, however, between the Clerk and the Otto engine is this—that the Otto engine takes gas and produces work only on every other stroke. We will suppose that the charge is in here [referring to diagram]; then the explosion takes place. Here is an indicator card, taken from engine No. 270, of the Otto type, under a pressure of 28 pounds, and with a maximum pressure of 125 pounds. Now, when the explosion takes place, the piston is driven out. There being no exhaust port in that engine, on the return of the piston the products of combustion pass out at the rear. It then takes in another charge, and the piston is carried on by the momentum of the flywheel ; as it returns, it then compresses the gas, and, on the next revolution, the explosion

takes place. In the Clerk gas engine, with every stroke you get combustion and power. As it reaches that point [referring to the diagram] the exhaust takes place. I do not undertake to say that the Clerk gas engine will use less gas than the Otto; not by any means. But there is the indicator card, and that is the result. That card is one of the best that we have obtained. We have had later and better results in England than those which I have given you. The price at which the Clerk gas engine will be furnished is a subject which has agitated our minds very considerably. We are, of course, all human; and, of course, we want to make the most that we can out of it. But, at the same time, as a gas man, I realize the necessity of placing an engine, in which I have an interest, before the community, which will not only do the work required, but which can be put upon the market at a moderate price. Our engine will not cost more than the Otto, and it may cost less How much less I am not prepared to say to-day. If you have been satisfied with the prices which you have been paying for the Otto engine, I think you will be satisfied with the price which you will have to pay for the Clerk engine. The great difficulty in starting all the engines of the third type, like the Otto and the Clerk, is to get up a momentum. It was a very demoralizing sight, the first time I saw one of the large engines, to see four men on the flywheel pushing and pulling, in order to get up the necessary momentum to start it. I said at once there must be a stop to that. The last time Mr. Sterne was in this country we talked over the matter, and a letter received by the last mail, a few days since, states that the difficulty has been overcome by a new device, and that the wife of one of the superintendents was able, without other assistance, to start a 25-horse power engine. So I infer that the plan which I suggested for overcoming the difficulty, which to me seemed a very serious one, has proved a success.

Mr. Greenough—In asking Mr. Goodwin the question with regard to the Clerk engine, I had entirely forgotten that he was in any way connected with the introduction of it into this country, and had no intention of putting him in an unpleasant position.

Mr. Goodwin—You need not apologize; I am pleased that you gave me an opportunity to make the statement.

Mr. Greenough—I am glad that Mr. Goodwin and other energetic gentlemen like him have taken hold of this thing. I think that for a gas engine of moderate cost there is a very large field in this country; but if the gentlemen connected with the gas engine business seek to make their profits too rapidly, I fear that they will not be so successful in introducing the engines to public favor as they would be if they sought only a fair return on the amount of capital invested. I have long been of the opinion that the man who should invent a successful gas engine had a large fortune before him; and as soon as it is put upon the market I have no doubt there will be an extensive demand.

Mr. Stedman—When the combustion is at the further end of the stroke, and the explosion has been accomplished, and the port is opened so that the compressed gases are discharged, what kind of gas then remains in the cylinder?

Mr. Goodwin—I will try to explain what takes place during one stroke, and that will probably answer your question. When the combustion has reached about this point, [referring to the diagram] and the compression cylinder alongside of the engine has received into it a charge of gas and air through a certain length of stroke, after it has reached that certain length the gas is cut off, and the air continues to enter. The piston has now reached the end of its stroke, and has commenced to return; and at this end the valve remains closed, because the pressure in here is greater than it is there. It is about 2 pounds here and it is about 41 pounds up there. So that, the moment the port is uncovered by the piston, and the pressure (which is 31 pounds at the moment it opens) drops. The instant this takes place the valve at this end opens, and, of course, in a very small fraction of a second, the piston, having returned part way, the turn of the crank has made a compression of several pounds; the instant it is released, the valve, working, lifts, and a current of air shoots through sweeping any of the products of combustion which had been

left in the cylinder through the exhaust port. But before the gas reaches it, the piston has returned and covered the port. Then, of course, it begins to compress, and as the pressure goes up the valve closes, and there is no further communication, but the gas is going into the cylinder, and getting ready for the next explosion. Does that answer the question?

MR. STEDMAN—Entirely. That shows how ingenious the process is for getting clear of the burning gas, and not having it contaminate the compressed air which comes in on the next charge.

MR. GOODWIN—You will observe that the air rushes in ahead of the gas, but before the gas reaches the port it is calculated that the piston will have come back and closed the same.

MR. VANDERPOOL—I would like to ask Mr. Goodwin whether there is likely to be any question of infringement raised between the makers of the Otto and Clerk engines, or whether these questions have been settled. It is a matter which will interest some of us who expect to buy the engines.

MR. GOODWIN—And it is a question which interests us. I will say, in reply, that people are known by their works. We have placed a large amount of money in the manufacture of these engines, and we further think we have the nerve and pluck to try that issue with anybody whenever it comes up. As to the question of infringement, that is something which I cannot answer; but I will make a little further explanation since this question draws out another fact. I do not wish to take up too much of the time of the Association with questions, and with explanations, but as the question has been asked me it only remains for me to answer. It is claimed that they have in the Otto engine what they call a "stratification;" and that the nearer you get to the piston, the nearer you are to pure air, and that the nearer you get to the back part of the explosive mixture, the more gas you have. Their claim, as I understand it, is as to the stratification of the gases; and that there is a cushion of nearly pure air right at the back of that piston. We have had some of the highest legal authority

in this country, as well as in England, to examine this claim for us, and to determine the question practically Mr. Clerk and Professor Thompson entered into a series of experiments. They drilled a hole in the cylinder, inserted a tube, and in that tube they put a valve, worked by a spring, which was connected with the connecting rod, and so arranged that they could take portions of the gas at any part of the stroke. They so timed it that, as the piston was just reaching the periphery of the tube, the valve would be open and the gas that was there, right at that point, would be forced up into that tube and then shut off by the spring. Therefore, they would have in that receptacle a charge of the gas which was immediately behind the piston. By this means they were enabled to prove that instead of its being a stratification, it was a perfect mixture all through the cylinder. As we understand it, their claim is stratification; and this experiment establishes the fact that there is none.

MR. VANDERPOOL—I understand that, in the case of Otto *versus* Linford, the English Court of Chancery decided in favor of Linford. This case was appealed, and the Supreme Court decided in favor of Otto, principally because Otto claimed, and appeared, to obtain his power and gradual expansion in his cylinders by means of a stratified mixture of gas, air, and the products of combustion ignited under compression. I am now told that in the Otto engine, as a matter of fact, the gases are not stratified, but the mixture of air, gas, and the products of combustion is complete at the time of ignition. But, in addition, a claim was made by Otto, but its validity was not determined by the court, which covered the mode of compressing the mixture—that is to say, the compression of the charge by means of the back stroke of the piston. It is this latter claim which some think to be so broad that its support by the courts would virtually prevent the building of cheap, uncomplicated, and economical gas engines.

MR. GOODWIN—In answer to this, I can only say that we must wait to be attacked, and if that question is raised it must be decided by a court.

MR. VANDERPOOL—But suppose that we purchase ten, fif-

teen, or twenty engines, or induce our consumers to purchase them; where is our protection if other makers should attempt to stop the use of the engines on the pretense that they are an infringement on their make?

MR. GOODWIN—I am not a member of the legal profession, and I cannot answer the legal bearing of that question. Of course, those are vital ones to us. We have given to them considerable thought and attention. We obtained legal opinions upon the subject before ever we went into this thing, and the fact that we have given out contracts to a large amount indicates our reliance upon, and our faith in, the opinions which we received.

MR. VANDERPOOL—Do those opinions cover the question with reference to the stratification of the gas, and also with reference to the compression of the charge. I understand the latter to be the main thing that they now urge; and they have given up this stratification feature because it did not really take place?

MR. GOODWIN—As I have said, I cannot tell what they will do.

THE PRESIDENT—Has not the Clerk engine been manufactured and used in England for some time?

MR. GOODWIN—The Clerk engine has been manufactured in England, and, to-day, it is working alongside of, or next door to, the Otto. The two companies have offices very near each other. Our people on the other side of the water have repeatedly courted an investigation of this question; and have sought to have it raised; and have stood ready to respond to any litigation that might grow out of it. But, as I have said, the best authority we have been able to obtain on the other side, merely confirms us in the opinion which we have formed, that there is no danger from an infringement. Of course I cannot say what these people may do. We often hear little mutterings to which we pay no attention. We are ready to meet the question whenever they wish to raise it. We have had the nerve to go into this thing, to put our money into it, to build these engines, and if you will have the confi-

dence to give us a reasonable amount of orders by way of encouragement we will take care of anything in the direction of a law suit.

FIXING SALARY OF SECRETARY AND TREASURER.

MR. SHERMAN—(Chairman of the Committee on Nominations)—Before making the report of this committee, I would like to bring a matter before the Association. I would like to ask on what grounds they raised the salary of the Secretary and Treasurer from \$300 to \$500. Unless there are some reasons which are apparent to those outside of the committee, I am not alone in thinking that the price named is too much. We all favor paying the Secretary a fair price for the services rendered, but we do not favor making the price so high that the office will be sought for because of its emoluments. In order to bring out an expression of opinion upon this subject I now move that the vote of yesterday which fixed the salary of the Secretary at \$500 per year be reconsidered, and that the salary be fixed at \$350.

THE PRESIDENT—Before putting the question on this motion I will state, as Chairman of the Executive Committee, that it was the sense of a majority of the committee that the price now paid the Secretary was not a sufficient remuneration for the time and service required to properly fulfil the duties of the office ; that our membership was increasing so rapidly that the Secretary must, in future, spend more of his time in properly attending to his duties than has heretofore been necessary. It was the idea of the committee that the Association would probably open an office in the city of New York to which all gas men might resort whenever they visited the city ; and that we should there have a man always ready to receive members ; and that this duty would probably devolve upon the Secretary ; and the increased membership would render necessary a more extensive correspondence. The committee thought that the sum of \$500 was not too much to pay a proper man to fill that position. The matter was discussed, and the resolution upon which the Association has acted was an expression of the sense of the committee. But, at the same time, the committee had no

intention of imposing its own ideas upon the Association. The matter was laid before the Association yesterday, and the recommendation was adopted. As our attendance to-day is much larger than it was yesterday, it is quite proper that the question should come up for reconsideration.

MR. GRAEFF—I move to lay the motion to reconsider upon the table.

MR. DENNISTON—That would cut off all debate, would it not?

MR. GRAEFF—Yes; but while it cuts off all debate those who wish debate can vote against laying the motion upon the table. Of course, if my motion is not carried then the motion to reconsider comes up.

The motion of Mr. Graeff to lay the motion to reconsider on the table was lost.

MR. DENNISTON—I did not intend to say anything upon this subject, but I would like to know what the other members have to say. The statement of Mr. Sherman yesterday indicated that, in the opinion of the Executive Committee, there should be an increase of salary; and the matter was talked of outside the hall. This morning I have heard different persons question the propriety of making this a position to be sought after for the sake of the money there is in it. It is true that $500 per year is not a very great salary; and yet who among us, even the most eminent of engineers, are getting at the rate of what this would pay for the actual amount of work to be done, and not only for the actual amount of work to be done, but for the proper person to do the work. There certainly is not in the work of this organization enough to consume any one man's time for a month, putting all of the work of the year together. The short-hand writer takes down everything that is said in the convention; and when the books are to be published they are simply copied from the reports which have already been published in the *American Gas Light Journal*. The books having been published, a boy can sit down, and, taking the list of members, direct and distribute the books among them. Where, then, does the work of the Secretary come in? The money

is deposited under the direction of the Finance Committee You now have about $1,300 in bank, and at the end of this year you will have about $2,500. Although I did not expect to say anything on this subject, I have my own opinion about it ; and would like to hear an expression of opinion from others. If a majority of the members think that it is proper to pay a salary of $500 I will make no opposition. But I do think, nevertheless, that $300 per year is a sufficient compensation for the work which the Secretary and Treasurer will be called upon to perform. I know that it is a little unpopular to be considered economical and parsimonious ; but I should suggest that if we have too much money on hand, or are likely to accumulate too much from our present charges for membership and annual dues, then let us reduce the fees ; if no one else offers such a resolution I will offer one reducing the annual dues from $5 to $3 or to $2.50. With our 300 members that will make our yearly income $900. About every second year you will have to pay $500 or $600 for the publication of the proceedings ; but you will still have a good balance in hand. The suggestion has been made that the Association should have an office in the city of New York, which shall serve as a rendevouz for members who are visiting the city ; but, I ask, how many gentlemen of this organization, extending as it does, from San Francisco to Nova Scotia, and North and South, who come here would care to occupy a room, or would go there to read the books of the Association, even if you had a library in a nicely carpeted office. A few of those in this immediate vicinity might frequent the place, but the New York members already have their association ; the New England members have their association, and the Western members have their association. So that when we meet here we meet for the purpose of digesting the various experiences of members of the different organizations we do not need any fancy meeting room here, because there is probably not more than one-tenth portion of the members who will come here oftener than once in five years, unless you should make the place of meeting annually in the city of New York. For these reasons I support the motion made by the gentleman from Connecticut to reconsider

a resolution which was adopted yesterday, and am in favor of maintaining the salary at the same figure which has heretofore been paid. Let us take this action and fix the salary before the nominating committee make their report, and before we know who has been chosen for the position of Secretary. Then if the nominee does not choose to accept the office I think there are plenty who will. Not that I advocate that the Secretary shall be asked to work for nothing, as I desire that whatever work is done shall be well paid for—that all the Secretary's expenses shall be paid, and that he shall also be paid for his attendance at the annual meeting.

THE SECRETARY—Lest any of my friends should make a mistake in this matter, I wish it to be distinctly understood that this increase of salary is not to benefit your present Secretary. It is a well-known fact that the Secretary does not desire a re-election. Although present at the meeting of the Executive Committee, in performance of my duty there as a member, I felt a delicacy when this matter of increase of salary was pending, in opposing it, as I did not know who my successor would be, and did not wish to dictate that his salary should be more or less than mine. I desired no addition to my salary; and if I had remained in the place should not have asked for any increase. As Mr. Nettleton, who formerly held the office, well knows, there is a great deal of work to be done in connection with the office of the Secretary. There is no boy who can edit your proceedings, as has been suggested. There is no boy who can take the printed reports of the meeting of the Association, as they appear in the *American Gas Light Journal*, containing, as they do, more or less of the jocular remarks which are proper enough for this meeting, but which are not proper to be placed upon the permanent record of the Association, and properly revise them, and it is impossible for this Association, made up as it is of members who are scattered all over the country, to appoint a committee of revision for that work. You must have a Secretary who has the ability to take the record of the proceedings, as they appear in the *Journal*, eliminate from it all objectionable matter (in the sense that we do not wish our little jokes and pleasantries to

go into a permanent record) and make up a volume which you will all feel is a credit to the Association. Every second year your Secretary has an immense amount of work to do in that line—I have done it for some years, and I know what it is. I helped Mr. Nettleton, who very ably filled this office before myself, and learned, while helping him, as a member of the printing committee, that he had a great deal of work to do, and that he was very illy paid at $250 per year. Then an addition of $50 per year was made to the salary; and I now feel that the compensation is ample for any gentleman who may fill this office at the present time. There is a sense of honor connected with it which may be considered in the light of part compensation for services rendered, because of the respect indicated by one's fellow-members in placing him there by their votes. That feeling is worth a great deal more than the salary. But do not make the mistake of supposing that there is no work to be done in this office, for there is a great deal of work; and no man who has not been in the office knows what that work is. There is a great deal of correspondence, and for as busy a man as I have been, and as Mr, Nettleton was in his own private affairs, the duty of properly attending to the correspondence is quite a severe tax. We do not have clerks to do that work for us. It is generally done by ourselves. It is fair that the Association should consider that fact. Individually, my idea is that $300 per year is salary enough; but do not be carried away with the idea that your Secretary has no work to do in performing the duties of his office, or that such work as is required of him can be performed by any boy.

MR. BUTTERWORTH—As a member of the Executive Committee, I believe I introduced that resolution, having understood, from our friend, Captain White, that he did not intend to offer himself as a candidate for re-election, and there would probably be a change. We now have over 300 members, and a great deal of correspondence is necessary. The preparations necessarily made for the annual meetings of the Association also occupy a good deal of time. Mr. White did not attend at Boston, and there was consequently some confusion there in

getting things into proper shape. We have generally had Major Dresser to help us, and we shall now miss his valuable assistance. As we were going to make a change in the office, we thought it proper to fix the salary before the nomination was made, and before we knew to whom the increased salary was to be paid. We would then be in a position to offer the place to a first-class man at a fair compensation. It is my opinion $500 is none too much. I would not like to do the work for $1 000 a year. I should like to see the man well paid, whoever he is, and whether working for us or anybody else. In this instance the amount of actual labor necessary to be performed is very large. The Secretary has to have somebody here to receive money from members, and make out the receipts. Sometimes it is necessary to have assistants to help in this work. We may be able to save hours of time in getting to work promptly the first day; and if we can do this, and get away so much earlier and return to our business, we may be able to save for ourselves much more than the difference between the $350 and $500 which it is proposed to pay the Secretary.

THE SECRETARY—In answer to the suggestion which has been made, that the annual dues should be reduced to $2.50 per year, I would suggest that the present charge is just about sufficient to keep the Association free of debt. The expenses of the year in which the volume is published, upon the basis of printing 600 copies and sending them out, is between $700 and $800. Of course, as the membership of the Association increases, and we continue to act upon the resolution to give two copies of the record to each member, we will, on the occasion of printing the next volume of proceedings, have to furnish 700 to 800 copies or more, to have enough additional copies printed to be able to supply new members as they may hereafter join the Association. It is, therefore, fair to consider that the expenses of the Association, outside of the salary of the Secretary, will average about $1,000 per year hereafter. It may be well to remember the fact that the Association has been a sort of a pauper heretofore. It goes from city to city; and, in the different places, it has had halls, entertainments,

and badges furnished by the gas companies, who have entertained the members. This practice has been a very bad one; and instead of reducing the dues as has been proposed, I would suggest that it would be better not to decrease them; and hereafter to pay for your entertainments, as you have never done before. I think it is the more dignified course for the Association to pay for everything it has; and the policy now seems to find favor with the members of no longer putting ourselves in the condition of chronic guests, going round from town to town, holding out our hats, and asking for entertainment. (Applause). We are now strong enough to entertain ourselves, and to pay our own bills; and certainly, any man belonging to the Association derives from it every year at least $5 worth of good, solid, information.

THE PRESIDENT—It has been moved and seconded that the amendment adopted yesterday, increasing the salary of the Secretary to $500 per year, be rescinded, and the salary brought back to $300 per year.

MR. HARBISON—Instead of fixing it at the same figure as formerly, I think the motion should first be to reconsider, and then afterwards we can fix the salary.

MR. SHERMAN—I intend to move, after reconsidering this vote, to make the salary $350.

THE PRESIDENT—The question now is simply upon the motion to reconsider the resolution passed yesterday.

The motion to reconsider was lost.

REPORT OF NOMINATING COMMITTEE.

MR. SHERMAN—(From the Committee on the nomination of officers). The committee beg leave to present the following report:

For President, William A. Stedman; Vice-Presidents, Eugene Vanderpool, A. C. Wood, T. Butterworth; Secretary and Treasurer, C. J. R. Humphreys; Finance Committee, John Andrew, G. S. Hookey, William Cartwright; Executive Committee, M. S. Greenough, Thos. Turner, M. N. Diall, William H. Pearson, C. E. Hequembourg, R. B. Dickey.

In regard to placing Mr. Pearson's name upon the list, it is proper that I should say that it was done against his wishes, he being on the nominating committee; but as this office had been held in one place, and by one company for several years, it was thought best, by the other members of the committee, that a change should be made.

On motion of the Secretary, the report of the Committee on Nominations was unanimously adopted.

On motion of Mr. Harbison, the Secretary was instructed to cast the ballot of the Association for the nominees recommended by the committee. The President appointed Messrs. Greenough and Turner, as tellers, to receive the vote of the Association.

The Secretary having cast the ballot of the Association as directed, the tellers so reported, and the President announced that the nominees had been duly and unanimously elected officers of the Association for the next year.

MR. VANDERPOOL—I think, Mr. President, that it has always been customary upon the election of a new president that he should be heard by the Association; and I, therefore, call upon Colonel Stedman for some remarks.

MR. STEDMAN (President-elect)—Mr. President, and gentlemen of the Association:—I am profoundly sensible of the honor of your election, and deeply impressed with the responsibilities of the situation. In order that I may not be overwhelmed by the disparity between my own small merit and the exalted station to which you have called me, I wish to ascribe a large share of your consideration to the credit of New England, an humble representative of which section I have the honor to be. I assure you, gentlemen, that I am deeply touched with this expression of your confidence, and I trust that neither New England nor the Association will have cause to regret your action of to-day, when I shall have fulfilled, to the best of my ability, the official duties which may devolve upon me. (Applause).

SECOND DAY—MORNING SESSION—OCTOBER 18.

A CHARITABLE MEASURE.

MR. FLOYD—It may, perhaps, not be improper for me to announce to the Association an accident which occurred yesterday. As it is known to most of you, the ladies of members of the Association, who are now visiting the city, were entertained yesterday by the Committee of Arrangements, and were driven in carriages to the various places of interest in and near the city of New York. It appears that one of the carriages containing three ladies, met with an accident; the driver was thrown from his seat, being so severely injured that his death is announced this morning. The accident might have been a very serious matter for the ladies, had it not been for the fact that the committee had taken the precaution to send a gentleman with every carriage. In the carriage to which this accident happened Mr. Harbison was seated. When the driver was thrown from his seat, and the horses started to run away, Mr. Harbison got over the front seat of the carriage, climbed to the pole and caught the reins in time to prevent a runaway. (Applause.)

MR. HARBISON—I wish to apologize to the Association for absenting myself for the first time from its sessions, and I thank the Lord that I did so yesterday. In that carriage were the wives of three esteemed members of this Association. The family of the poor driver being practically in destitue circumstances, I move that the Treasurer of this Association be authorized and instructed to pay from the funds of this Association to the representatives of those orphan children the sum of $100. I think it is due to ourselves, as members of the Association, to take some such action in this particular case. It is fitting that we should make some proper recognition of the family who are by this unfortunate accident left without support. There are, as I understand, three or four children who are left orphans by this accident.

MR. DENNISTON—I move to amend, and make the appropriation $300.

Mr. Harbison—I will accept that amendment.

Mr. Harrington—I move to amend by making it $100 for each child.

Mr. Harbison—I do not know how many children there are, but I will also accept the last amendment, and hope that it will prevail.

Mr. Stanley—Would it not be better to refer the matter to a committee to ascertain the facts, and afterward decide as to the proper amount of appropriation. There may be ten children.

Mr. Harbison—What if there are? Suppose there are twenty children. If there is not money enough in the treasury to give an appropriation of $100 to each, I am willing to pay my pro rata share to raise that amount. I think that it is due to us as members of the Association to adopt such a resolution, and that we should all feel that we had done something in helping this afflicted family by taking action as members of the Association. I hope that the last amendment will prevail, and that we will contribute $100 for each child, no matter whether there be three, five or twenty. Let that amount be appropriated, and if there is not sufficient money in the treasury to make the payment, let an assessment be levied upon the members for the deficiency.

Mr. Stanley—I do not object to that; it is all very well; but the question with me is, whether it would not be better to have a committee take proper action in the premises. No matter about the number of children—let us make an appropriation for each; and if there is not enough money on hand I would advocate the appointment of a committee to raise a subscription from the members in order to meet the expenditures.

The Secretary—There is plenty of money on hand.

Mr. Graeff—I am one of the newest members of the Association, and perhaps it is not fitting that I should express an opinion upon this proposed action; but still I wish to say that I do not think it worth while for the Association to do what Artemus Ward called "slopping over." I believe in contri-

buting a fair amount to the family of this driver. While I am willing to vote to the driver a respectable sum, I do not see the necessity of going around among the members for the purpose of raising a subscription; although, if that be done, I am willing to put my hand in my pocket and contribute in equal proportion with the rest. I do not, however, see the necessity for the Association beggaring itself because we were unfortunate enough to have ladies in the carriage which this man was driving at the time. I do think that the Association owes a vote of thanks to Mr. Harbison.

THE PRESIDENT—The question is on the amendment to the original motion, to make an appropriation of $100 to each child.

MR. HARBISON—The amendment is accepted, and made as the original motion.

MR. M. F. THOMPSON—Should not somebody be designated to receive this money in behalf of the children?

MR. HARBISON—It is to be given to their legal representative. I will, however, add to the motion that a committee, consisting of the Treasurer and Mr. Floyd, be appointed to receive the money and pay it over to the proper person; then Mr. Floyd (whose sons were of the party yesterday) will investigate the case, and see that the money is placed where it will do the children the most good.

THE PRESIDENT—It is moved and seconded that the Secretary and Mr. Floyd, as a committee, be instructed to investigate the condition of this family, and to pay them, from the funds of this Association, the sum of $100 for each child left orphaned by the accident.

MR. STANLEY—It seems to me this money ought to be placed in the hands of somebody to be spent as the case may require.

THE PRESIDENT—I think that that can be left to the discretion of the committee.

MR. STANLEY—If it is left in the hands of this committee, I am perfectly satisfied.

MR. STARR—Are we to understand that the instructions of this Association are that the committee should pay the amount over at once, or that it shall be used by them from time to time, as it may be needed by the children, and as they may deem best and wisest. It may be bad policy to at once put $400 or $500 into the possession of this family.

THE PRESIDENT—I think that we can safely leave that to the discretion of the committee.

MR. STARR—If you will leave it to the discretion of the committee, to use the money as they may think best, I am perfectly satisfied.

MR. FLOYD—I think that it will be well to leave this matter entirely in the hands of the committee. We will distribute the money in whatever way shall seem to us best for the interests of the children, and with the view to having them properly taken care of.

The motion, as amended, was agreed to.

A recess was then taken until 2 P. M.

SECOND DAY—AFTERNOON SESSION.

The Association re-convened, at two o'clock P. M.

THE PRESIDENT—The next paper to which we shall have the pleasure of listening, will be read by T. O'Connor Sloane, Ph. D., on a "Self-Registering Photometer."

MR. SLOANE then read the following paper:

SELF-REGISTERING PHOTOMETER.

Several attempts have been made, during the past few years, to construct a self-registering photometer. One of these was founded on a very curious property of the element selenium. The electrical conductivity of this element varies with the degree of light to which it is exposed. As it is a very simple matter to register the intensity of an electrical current, it might be supposed that in this a basis might be found for registering

the intensity of light. The trouble, however, in attempting its application is in producing the original current. To carry out the idea it will be seen that this, too, must be constant, and nothing is harder than the production of an absolutely constant electric current.

Another attempt at the solution of this problem was sought for in the jet photometer. A piece of sensitized paper was made to slide, by machinery, across a slit through which the light from a jet photometer flame fell upon it. The height of the flame was thus photographed upon the piece of paper, and this was reduced, by the usual scale, to candle power. Starting with an unreliable instrument this method of reading only added to the original defectiveness of the instrument itself. It is hard enough to read a jet photometer accurately as far even as the absolute height of the flame is concerned. Then, when such reading is reached, the trouble only begins, for its ratio to illuminating power unfortunately is very variable, and where the gas varies largely in specific gravity, it is quite worthless. If adjusted for one gas it will not answer for another. These original defects, well known to all of you, of the jet photometer, were supplemented by the imperfect and hazy photograph of its flame that was obtained. There was no precision or even appearance of precision.

Some years ago, a paper was read, before either this or the New England Association, by Mr. Goodwin, giving the results of some experiments with the scientific toy, called Crooke's Radiometer. Mr. Goodwin found that the rotations of the wheel of this instrument, or, in more general terms, its intensity of action, varied in the ratio of the square of its distance from a source of light. From this, the conclusion was drawn that the instrument probably was affected by light radiations, and not by heat radiations. It is now considered, however, an established fact that it is the radiations of heat that do affect the instrument in question. This might seem to upset Mr. Goodwin's conjecture, but it does not. The accuracy of his work is verified by an almost physical certainty. This certainty is the identity of radiant heat and light. The most acceptable theory, at the present day, is that both these forces are the

same, and that radiant light is a phase of radiant heat, and included in it.

The heat radiated by a flame consists, for the purpose of this subject, of two parts—obscure heat, and luminous heat, or light. These two elements can be separated with considerable accuracy. A solution of alum contained in a glass trough does it very effectually. Only a small percentage of obscure heat can pass this screen. If in front of a gas flame we place a trough, perhaps half an inch thick, and four or five inches square, with glass sides, and filled with such a solution, the radiations of heat from a hot bar of iron, for instance, assuming it to be heated below redness, will be almost entirely cut off, while a very large percentage of the heat from a gas flame will pass through. We can simplify this. We find that a glass plate will cut off a great deal of obscure heat. Therefore if we pass the rays from a gas flame through such a plate we shall have a separation of the rays into two parts. One composed almost entirely of obscure rays will not get through the plate—the other, consisting of a mixture of obscure and luminous rays, will go through. You can readily see what the effect of this is. A concentration of the luminous heat, or light rays, takes place, and we have a purer light radiation after the light passed through the plate than before.

Then, if a means for measuring mechanically such radiant light can be devised, we have one of the elements of a registering photometer. We have seen from Mr. Goodwin's experiments, that Crooke's radiometer furnishes us with it. But this instrument cannot well be made self-registering, and, from a long series of quite exhaustive experiments, I succeeded in constructing a peculiar thermostat, whose motions were affected by radiant heat or light with great exactness, and whose motions, moreover, were susceptible of registration.

Here was the first element. The next was to obtain a gas flame of exact consumption. This was a great difficulty. If we go through the whole range of gas appliances, we will find none that will afford us such a flame. The most perfect governors are not adapted to do it, for the amount of gas they pass will vary with its specific gravity.

So fully does this constitute their principle, that, by measuring the gas passed by the most perfect of them, the specific gravity of the gas can be ascertained approximately.

This difficulty I overcame by an application of the great time measurer to a meter. A heavy pendulum was attached to a meter working in connection with an escapement attached to the drum. This worked a peculiar governor, and effected two things. It first made the meter, if a wet meter, which, for accuracy, is always to be preferred in scientific work, rotate with exactly the same speed whatever the pressure or specific gravity of the gas. In the second place, it kept the water in the interior of the meter drum at almost exactly the same height, whatever the pressure and specific gravity of the gas might be. For the most extreme variations in these factors the range was quite immaterial perhaps not the hundredth part of an inch.

Thus, again, the meter could be, and was, made to perform two functions. One was to regulate exactly the gas that passed, the other was to act as a time piece.

These two pieces of apparatus I combined. The meter was made to bear an Argand flame on its top, and to carry a support for the thermostat. This flame was regulated so that it always burned five feet per hour. The radiations from the flame, after two siftings, one through the glass chimney, the other through the glass of the thermostat, acted on this instrument, and caused it to move. The meter also moved a strip of paper across its top, and, on this strip, on exactly the same principle as a pressure gauge, the movement of the thermostat was recorded. By preference I used a fine needle point, which perforated the paper at intervals of a few minutes; I believe it was about one puncture every five minutes.

Two photometers, one very primitive, with which I performed my early experiments, have been completed and have proved wonderfully accurate. I incline myself to the belief that, properly used and occasionally standardized, they can be made more accurate than the bar photometer as ordinarily used. The latter is always subject to personal errors, and variations due to the candles.

I have tested the thermostat rigorously, and have found it of undeviating accuracy, through a wide range of candle power. From this it follows that the whole instrument, properly used, will be as accurate as the thermostat. Such accuracy will exceed that of the bar photometer as ordinarily used.

There is one source of variation which has to be provided for, and that is the light of the sun. This affects the instrument seriously, but can be easily provided against. The instrument may be kept in a dark room—where this may be inconvenient, a simple case, such as used for the jet photometer, but blacked inside, will answer, or a still smaller case resting on top of the meter, and inclosing the flame and thermostat, may be used.

The size of the whole apparatus can be gleaned from what I have said. The base of it is a photometer meter. On top of this comes the flame, thermostat, and registering apparatus. This increases the height to about thirty inches. This is the whole apparatus.

There is really no difficulty in using the apparatus, though a little cleverness is required. Any one who can really be said to understand an improved bar photometer can use this one without trouble.

Discussion.

The President—Have you any record of the tests which you have made?

Mr. Sloane—I have a record of a very extensive series of experiments which were made by me. I had the gas come in directly from the gas works, connected with an old photometer, and had the same gas connected with the new photometer. I continued to photometer the gas hour after hour, and took five or ten minute observations, at the same time reading the new photometer. In that way I had a variation of candle power, with my photometer, of from 10, to 18, and 20 candles. Sometimes the variations would be larger still, because, when the purifiers were open, the candle power of the gas would run very far down. In all cases I found that the photometers ran together as accurately as could be expected, and any differ-

ence which I found was to be attributed to my personal error in reading the bar photometer.

On motion of Mr. Sherman, the thanks of the Association were tendered Dr. Sloane for his interesting paper.

NOTES ON EXPERIENCE WITH IMPROVED FURNACES.

THE PRESIDENT—We have no other paper on our list, and we have an hour remaining which may be devoted to any topic which will be of interest to the Association. We had yesterday some very interesting notes from Mr. Stedman in regard to the furnaces which he is now using. If Mr. Slater is in the room, he may be able, from his extended experience with regenerator furnaces during the past twelve months, to give us some interesting data; and we would all very much like to hear from him as to the results which he has obtained.

MR. SLATER—I do not know that I can report anything in addition to what I have already said at previous meetings of the Association. Our furnaces continue to do about the same work as heretofore.

THE PRESIDENT—The fact that you are still satisfied with them, will tend to encourage many members who have not yet tried them.

MR. SLATER—I will not say that we are well satisfied with them, because we expect to improve them. We do not think that they are the best that can be devised; but they are the best that we have tried so far, and we are able to do better work with them than we were with the old furnaces.

THE PRESIDENT—And, with your experience, you would not go back to the old furnaces?

MR. SLATER—Not at all. We have been able to average from 10,000 to 11,000 feet per retort all the while, and are able to do that with the same kind of fuel, and with the number of pounds of coke to the ton carbonized as before stated, which is about 16 pounds of coke to each 100 pounds of coal carbonized.

The President—Have you been troubled at all with pitch in your mains, or with stopped pipes?

Mr. Slater—No.

Mr. Stiness—What percentage of coke is that?

Mr. Slater—It is 16.17 per cent. of coke to each 100 pounds of coal carbonized. I think that Mr. Stedman has done even better than that with his furnace. We have adopted the style of main which has a plate, on the back side of the main, at which we can take out the heavy tar or pitch, if there be any made. During the year and a half that we have been using that main we have taken out but few plates.

Mr. Allyn—How about the durability of the furnaces. Has Mr. Slater used the furnace long enough to be able to give us an idea of about how many months a furnace of this kind will last before it is necessary to renew it?

Mr. Slater—I am not able to state, from memory, just how long a furnace will last. It may last a year and a half or two years.

Mr. C. H. Nettleton—Since the last meeting I have continued to use the furnaces, and am very much pleased to be able to report that they are doing better for me now than I have ever been able to make them do before. Some of you, who were at the New England meeting a year or two ago, may remember that I there read a paper on the furnace in which, probably through bad management, I stated that I used up the retorts in about four months, and the furnace in about the same length of time; and that they then had to be rebuilt. Through not trying to force them so hard, I am able now to say that I have been using one furnace continuously for the last fifteen months; and that both retorts and furnaces are in such a good condition as to warrant me in saying that they will last, I think, for three months longer. I have not been able to reach the results which Mr. Slater or Mr. Stedman have accomplished. I doubt if it is possible, with the ordinary regenerative furnaces, to reach the result which Mr. Stedman gives. In some way, or for some reason, Mr. Slater is able to run three-hour charges, and the rest of us cannot. I

wish that we could. I can now produce between 8,000 and 9,000 feet per retort, our retorts being 14 by 22 by 9. I use, in firing the furnace, the coke from the two bottom retorts. From the ash-pan I save sufficient coke to nearly run the boiler at the works. If I should use that coke in the fire I presume the percentage would be about 23. To save the clinkering, which would naturally result from its use, I prefer to burn it under the boiler, and think this is a more economical proceeding. A year or two ago the furnaces were run in such a way as to necessitate drawing the coke entirely out; then the men were obliged to pound the clinkers off of the furnace by the use of large heavy bars. During last summer, by the use of a new tool, which the stoker suggested, and which is a heavy bent poker, they reach into the furnace and thus break off the clinkers. I am happy to be able now to say that one of my furnaces has not been broken down for five or six weeks; and I hope to run it indefinitely without breaking it down. If I can do so, it will be a very great gain, because that work was trying on the furnace by reason of pulling it down, and it was excessively trying on the men, and on their tempers. To get the greatest economy in the running of regenerator furnaces, I think that we have got to make them in the recuperative form. We must heat the secondary air supply by our products of combustion. That must be accomplished; and that will effect a saving of coke. To do that we must so construct our furnaces, in burning the coke, to produce the carbonic oxide gas, and, at the same time, to burn our coke into ashes, and not into clinkers. How that will be accomplished, I do not know. We are all working to do it, and I think it will be done sooner or later. I think the true solution of the problem lies in building larger furnaces, and I have acted upon that theory and have built my furnaces so large that the coke will stand in them 5 feet deep. I hope, at the next meeting, to be able to report favorable results from those furnaces; but that is, of course, a matter for the future to determine.

EXHIBITING A SERVICE PIPE WHICH HAD BEEN FUSED BY THE EDISON CURRENT.

THE PRESIDENT—We have here a service pipe, sent by the New York Gas Company, which has been fused by an electric light wire. Mr. Lees is in the room, and we would be much obliged to him for such information as he can give upon the subject.

MR. LEES—The pipe was the usual iron gas service, lap welded, 1½ inches in diameter and 3-16 thick, perfectly sound, running through an area in the ordinary manner to supply a building. In June last a fire occurred at that building; we found, on investigation, that the electric wire passed alongside of the pipe. The insulator covering of the wire becoming broken in spots, the electric current caused this injury to the service here shown. The immediate effect was to let the gas escape, ignition immediately following, with the consequence that a lively conflagration resulted. The section of pipe shown (for illustration of which see *Journal* of August 2, 1883) was cut off by the Fire Department officials. This is not the only case of injury by reason of contact with electric light wires. Only this week we had a meter destroyed. A supply wire was located near a meter, and this is what happened: A gentleman, while seated at a desk in his office, noticed what he called a flash of light; he was curious enough to institute an immediate search as to its origin, and found that the "flash" was in reality an electric spark developed by reason of a switch-key being located near the meter. The spark left the key, and impigned upon the meter, burning a hole through it into the gallery, and causing a slight explosion. The gentleman immediately shut off the gas supply, and his investigating turn of mind thus probably saved the building from destruction by fire. We have had perhaps half a dozen cases of trouble from the electric light wires, but these two are the freshest in my memory. I wish to repeat the invitation of yesterday—that any gentleman, choosing to visit our works, will be cordially welcomed there. Our manufacturing establishment is only a short distance from here; and whenever any of you are in the city we

will be glad to see you. We have made some changes in our plant which may, perhaps, prove interesting to you. We have a meter which is quite a curiosity, by reason of its size, and our holder is a little different from the ordinary style.

The President—As your company has been the one most directly brought into competition with the Edison incandescent light, the Association would like to hear from you something about the progress made in electric lighting in your district, and also its effect on your gas consumption.

Mr. Lees—I was asked that same question, by a director of our company, at a meeting held some time since. He inquired what effect the electric light had had upon our business. I do not know any better illustration to give than by comparing it to the effect exerted by the presence of a fly on a loaded coach. The fly is there; but the horses do not know it. I know that the electric light is in our district; I occasionally see one of them; but as far as regards any tangible effect exerted upon our business we do not know that it exists.

Mr. Greenough—Were those holes in the gas pipe just shown fused by an incandescent or an arc light supply wire?

Mr. Lees—By an Edison incandescent light wire. Both the accidents mentioned by me were caused by Edison wires

The President—The managers of the American Institute Fair have sent us 50 tickets of admission. Any of the members of the Association who desire to visit the fair, and see the Clerk gas engine in operation, can call upon the Secretary for tickets. Mr. Goodwin has also handed me some cuts of the new Clerk engine, which he has just received; they can be found upon the desk of the Secretary for inspection by members of the Association.

On motion of Mr. Sherman, the thanks of the Association were tendered to Mr. Lees for his attention in presenting the pipe to the Association, and explaining the circumstances leading to its injury.

Mr. Allyn—If it is in order, I would like to make a motion that, at our next meeting the Committee of Arrangements be instructed to have programmes prepared and printed, in order

that the members may know what the proceedings at each session of the Association will be. I think it is extremely desirable that we should know in advance at what hour the different papers are to be read. In any city where we meet there are many places of interest that members would like to visit; and by knowing when certain papers are to be read we can divide up our time to the best advantage. The expense of printing a few programmes would be very slight, and then every member would know just what the proceedings of each day would be.

THE PRESIDENT—That has always been the custom heretofore. With regard to reading papers, I wish to say that unless the members of the Association will carry out the rules of the organization they will never be able to know in advance when papers are to be read. There is a clause in our constitution which provides that all papers to be presented at any meeting of the Association shall be sent to the Executive Committee before the meeting, in order that the Committee may know exactly how many papers will be read, and in order that they may make just such a programme as has been asked for. Until the very hour of this meeting of the Association, we did not know what papers would be presented to us. None of the members responded to the printed notices sent by the Secretary asking for that very information. It is impossible to make up a programme beforehand unless the data upon which that programme is to be based can be ascertained. It is proper enough that this resolution should pass, instructing the Washington Committee of Arrangements to issue a programme for the next meeting; but the Committee of Arrangements cannot compel the members to hand in their papers unless they choose to do so.

MR. HELME—I think it will be necessary to have a Committee of Arrangements appointed for the Washington meeting. I do not remember that any has yet been named.

THE PRESIDENT—The Committee will be named presently.

MR. G. S. PAGE—As the subject of the work of the local Committee of Arrangements has come before the meeting, it

may be proper for me to say a word in explanation of what has undoubtedly been the experience of very many of those who have come here from a distance. Certain members of the Committee endeavored to make arrangements with a number of our larger hotels for the accommodation of the 100 or 125 members who we anticipated would be in attendance at this meeting. As a matter of fact, we could not make an arrangement with any hotel in New York to give certain accommodation to any number, not even so few as 25, until General Roome became associated with the Committee, and personally went to the landlord of the Westminister Hotel. He agreed to care for 75 guests in his own house, and to guarantee accommodations in other hotels near by, through interchange with those hotels, for 75 more. October is the busiest month of the year for the hotels in the city of New York—a city which is not well accommodated with hotels. There are more business people now visiting the city, and more foreigners arriving, than ever before, and many more than can be properly accommodated. The hotels are filled to overflowing. We trust therefore, that our friends, having heard this explanation, will be the more ready to make allowances for any inconveniences which they may have suffered by reason of their failure to find in this city the magnificent accommodations which have been furnished them in Boston, in Chicago, and in other cities visited. The Committee had endeavored to do all that they could to make your presence here comfortable and enjoyable; but they have had this difficulty to contend with. Perhaps I might also appropriately make a reference to this place of meeting. In the hotel there was no room large enough for the meeting of the Association, and it was necessary to look elsewhere for a hall. Therefore we took this room (which is not an exceedingly agreeable place), because it was convenient to the hotel, and because it was thought to be of a proper size. We could have got larger halls, but we did not think it wise to do so. Will you, therefore, accept this as an apology from the Committee, who have endeavored to do the very best they could under the circumstances.

STOPPED STANDPIPES.

MR. GEORGE CORNELL—If there is nothing now before the meeting, I would like to refer again to a matter which was alluded to by Mr. Pratt in his paper of yesterday. It was an allusion to the nuisance of stopped standpipes. I have thought that perhaps it was my duty to give the little experience of our company. We have had no trouble with stopped standpipes for about 14 years. I do not know that we have had a single stopped standpipe in that time. The way in which we have prevented it is this: Our superintendent, about 14 years ago, devised a plan of keeping the standpipe cool by having the pipe doubled, and having a water jacket around it, and keeping the space between the two pipes full of water. Of course it was some trouble to arrange that on a bench of retorts with double standpipes, with all the necessary small pipes to bring in and carry off the water; and this was especially true when we attempted to adapt it to mains of large size; it was then a very complicated arrangement. Then our superintendent made a little deviation from that plan, which, after a year or two of experience, he found to work equally well, and which is much simpler. The arrangement is this: He has the mouthpieces cast with a bowl on the top, through which the standpipe passes. That bowl will contain about two gallons of water, and a current of water is kept passing through all these bowls, entering near the top of the retort, passing in a zigzag direction to the bottom, and then passing out. It answers the purpose admirably.

MR. HELME—How deep is that bowl?

MR. CORNELL—Perhaps there is not more than six or eight inches depth of water.

MR. HELME—I think that you, Mr. President, had some trouble with stopped standpipes in New Orleans; but it strikes me that the stoppage there was very much further up.

THE PRESIDENT—It was everywhere.

MR. HELME—I thought so about that time; but I thought that the fellow who was trying to unstop them knew where it was, and what he was about.

The President—The most remarkable thing connected with those stoppages is that, when I went home from the meeting of the Association, determined to try the only thing we had not tried to prevent the stoppages, I found that, in the meantime, the stoppages had ceased of their own accord ; and, under identically the same circumstances of working, I did not have any trouble of that kind during the next twelve months.

Mr. Helme—Out of quite a large number of benches, we would have only one bench stopped this week and another bench stopped next week ; and Mr. Forstall admitted that he knew of no reason why they should skip about in that way. I think it is very singular if a bowl of water twelve or fifteen inches deep on the mouthpiece will accomplish that thing for everybody. I am inclined to think that there is something peculiar about that case, and that the remedy would not be as efficient with others as it has been with Mr. Cornell.

Mr. J. H. Walker—I have had a little to do with stopped standpipes, and I would like to hear all about it from somebody else. When I am in trouble I like to hear from others who are in the same trouble. I used to have a great deal of bother from stopped standpipes. I tried all sorts of things—water and steam, and everything else. There is a good deal of trouble in the water and steam business. I increased the size of the standpipes, and that helped me just a little, in delaying the stopping up. I then tried all kinds of pipe cleaners. I found that the trouble with the pipe cleaners was that they would not go up the pipes without somebody at the end of them. I finally adopted a pipe cleaner that cuts both ways. It is made of steel. It cuts up, and it will cut as it comes down. The only way that I can keep my standpipes clean is by using this instrument after every charge. Since I have used that I can say that I have never had the lid of a retort taken off to clean the standpipe. I make the largest cutter within half an inch of the diameter of the largest pipe. I insist that the pipes shall be clean when they are first put up, and I insist that the cleaner shall be put up at the end of each charge, in order to keep them clean. I do not try to put up a

2-inch cleaner in a 6-inch pipe, as that only makes a two inch hole, and the pipe stops up again right away. I wish to ask the gentleman who uses the water jacket what kind of heats he had which enabled him to keep the water cool all the way up.

MR. ROBERT BAXTER—Stopped standpipes have been discussed a great deal, and as no remedy has apparently been found for them, I will relate my experience. When I used coal from the Clover Hill Mine, in Virginia, I did not know anything about stopped pipes, and I did not know anything about naphthaline; but since I have been using coals from Pennsylvania and from West Virginia I find the standpipes and the bridge pipes stopped solid, and have to be frequently taken down and burned out. It has been impossible to get the mass of naphthaline and pitch out of the pipes in any other way than by building a fire in the yard and putting them on it. I have known them to be stopped in half an hour after they had been cleaned. I attribute such stoppages to the kind of coal which we use, and to the heats that we employ. When our heats are not very high we are not troubled with stopped standpipes; when running at very high heats we are liable to frequent stoppages. I find, even in different samples of coal from the same mine, that one week we will have stopped standpipes, and another week, with the same coal, but probably from another portion of the mine, we will have no stoppages at all, but work right along very easily. I have been getting along without any stoppages for nearly the whole summer. But just before leaving home we had a good deal of annoyance with stopped pipes, more particularly with the bridge and dip pipes. We use a cleaner in the standpipes, and keep them comparatively clean; but we find it a very difficult matter to keep the bridge and dip pipes in a serviceable condition. Before I left home my foreman asked me to find out some way of getting rid of stopped pipes; and I would like to do so.

MR. STARR—What kind of cleaner do you use?

MR. ROBERT BAXTER—We have a strong cleaner that follows up the inside of the pipes. It spreads out as it is forced up the pipes.

Mr. Starr—We have been using a cleaner for the last ten years which cuts as it comes down, and when the charge is changed we introduce that cleaner. We push the cleaner up on one side and pull it out on the other, and it cuts everything out. We do not have trouble from stopped pipes over once in three months. We never have any trouble at all with the bridge and dip pipes.

Mr. Sherman—I will call attention to a very simple device, which Mr. C. V. Smith, of the Manhattan works, called my attention to, for cleaning out stopped standpipes. He informed me that when he scurfed his retorts with the Edge process he allowed a jet of steam to enter the standpipe at the same time, and that thoroughly removed any obstruction, and thoroughly cleaned it out.

Mr. Robert Baxter—I have tried steam in the standpipes, but it does not prevent their stopping. Every time a charge is put into the retorts the standpipes are thoroughly cleaned out.

Mr. Harbison—I wish Mr. Sherman would tell us something further about Engineer Smith's remedy. How often does he clean and scurf his retorts? And has he any stopped standpipes between times? It ought not to be necessary to clean them every week or month, and have stopped standpipes occur in the meantime. It is all very well to clean out the standpipes whenever the retort is cleaned; but how often is it necessary to (or how often does he) clean the retorts?

Mr. Sherman—He did not mention the time; he only called my attention to the fact that a jet of live steam would remove anything which collected in the standpipes. I have had no occasion to try it myself, because I do not have any stoppages.

APPOINTMENT OF COMMITTEE OF ARRANGEMENTS FOR NEXT MEETING.

Mr. Hyde—I understand that no Committee of Arrangements for the Washington meeting has yet been appointed. I therefore move that a committee of five, with the Secretary, be appointed by the Chair, with power to make all necessary

arrangements for the next annual meeting, to be held in the city of Washington ; such committee to be styled the "Committee of Arrangements."

The motion was agreed to, and the President appointed the following Committee of Arrangements :

Messrs. Geo. A. McIlhenny, Washingion, D. C. ; Wm. Helme, Philadelphia, Pa. ; Fred. J. Davis, Waltham, Mass.; Thos Turner, Charleston, S. C. ; Wm. H. White, New York city ; and C. J. R. Humphreys (Secretary-elect), Bergen Point, New Jersey.

MR. HARBISON—It is a well-known saying that " merit hath its reward," or ought to have its reward, in all cases. We have to-day elected a gentleman (who, as some people say, does not belong in the United States, because he hails from the State of New Jersey) to the office of Secretary and Treasurer of this Association, to perform the duties appertaining to the office now held by our valued friend William Henry White, who is, as everybody knows, a particularly modest man. I think it would be unkind to allow this meeting to terminate its session without some expression from the members of the Association in regard to the way in which he has performed his duties during the years in which he has been our Secretary. I wish, as an individual member of this Association, coming from a city which, as most of the members know, is noted for the modesty of its citizens, and also in behalf of the gas works which I represent personally, as well as in behalf of all these gathered brethren, to move that the thanks of this Association be tendered to William Henry White, for the earnest, faithful, gentlemanly way in which he has always been ready, during all these years, to stand by our wants and necessities, and to provide for them ; for the way in which he has kept his records—and his record is good ; I do not know anything against it, and I know him pretty well. I therefore move that the thanks of the Association be tendered to him for the able and efficient manner in which he has performed his duties during the past years as our Secretary and Treasurer. I know that his bank account is good, from the report which he has made as

Treasurer of the Association ; and I know that he leaves the position with credit and honor to himself, and with a good credit to our account in the banks where the money is deposited. (Applause.) I move that the thanks of the Association on this motion be taken by rising.

The motion was carried unanimously by a rising vote.

MR. W. H. WHITE—Mr. President and Gentlemen of the Association: It has been frequently said, and frequently very well said, of some lately departed brother, that nothing in his whole life so became him as his taking off. Possibly, in this moment of your intense gratitude that I shall no longer preside at this desk as your Secretary at your annual meetings, you offer this very touching and spontaneous manifestation of your regard for me in the manifold positions in which I have served you. But, all joking aside, it is very touching to me, because of the very deep friendships I have formed with the members of my profession in this Association. I was one of the earliest members. In fact, at its very inception I worked hard in its behalf. It may have slipped the memory of all, except some of our oldest members, that, at one very trying period of our existence, this Association was not only very near the grave, but it actually had one foot in it; for it had appointed a committee to consider the advisability of giving up the effort to establish the Society. At a meeting held in New York city, at the old Masonic Hall, on Thirteenth street, in 1873, at a time when I had just risen from a bed of illness, I was, very much against the advice of everybody at my home, driven over to that hall, reaching the meeting just in time to find ten or a dozen men who were there, sitting around in a very lachrymose style—looking, in fact, as if a corpse was about to be borne out. Inquiring the matter of business under discussion, Mr. DeMill, who was then in the Chair, said that they were considering the advisability of discontinuing the Association. My dear friend, George McIlhenny, was there; and I said to him, "This thing ought not to be. Who has any 'pet corns' that I can tread upon immediately?" He named one or two gentlemen, and I proceeded, in my roughshod way, to get on to their

'pet corns,' and stirred them up in the most effective way for about an hour; and when the committee came in to report that the thing was dead before it was born, that committee found there the liveliest body of men that ever you saw. They voted down the resolution to disband; and right there and then this Association took a new start, and it has been a success ever since. As Secretary, I have tried to serve you faithfully. I took from the hands of my predecessor, Mr. Nettleton, the duties of this office when he was willing to lay them down, because no other member seemed willing to take them up. I knew that I had to place my record alongside of one that could not be assailed or bettered in any way. I have endeavored to so transact the duties of the office entrusted to me that I could leave it with some credit to myself and no discredit to you. Your courtesy this afternoon assures me that you believe I have done my duty; and I assure you that I deeply and sincerely thank you for many warm friendships, for your appreciation of my efforts to serve you well, and for your many acts of kindness to me during many long years. (Applause.)

IN MEMORIAM.

GEN CHARLES ROOME—Mr. President and Gentlemen of the Association: Some five or six months ago Major Dresser, an honored member of this Association, and a warm personal friend of mine, felt that his death was rapidly approaching. He made a request which I did not know of at the time; when I went to see him he was so far gone, and was in such pain and suffering, that I was not able to converse with him. He said to a friend of his and of mine, "If I should not live to return, I ask, as a favor to me, that, when the next meeting of the Gas Light Association is held, General Roome will say a few kind words of me to my former associates."

It is not necessary for me to go into the history of his life. It was published in the *American Gas Light Journal*, and you have all read it there, I presume, for there is hardly a member of this Association who does not receive and read that paper. His request was that I should occupy but a very few minutes.

Why he asked me to do it was perhaps for this reason: As I was the first President of this Association, and was mainly instrumental in its organization, and deeply and earnestly devoted to its welfare, he thought it meet that, as I had been honored by it, a few words spoken by me to the members would perhaps have more effect upon them than coming from any other member. I need only say that his history is there recorded. Being only an honorary member of this organization, I have, perhaps, no right to offer a resolution. But I hope that you will set aside a page of your record, and copy there this obituary, which is clear and distinct, and shows the history of this most excellent and good man.

I can say this of Major Dresser—that he was a gentleman in the fullest acceptation of the term. He was a noble-hearted man and a brave soldier. Educated for the service of his country, he devoted the best part of his life to that cause. As a Christian he was calm, humble, pure, and sincere. As an engineer he was highly accomplished; and had he lived he would have been to this Association one of its most valuable members. He loved his profession; he believed in it. He believed in its usefulness, in its aim, and in its dignity. He believed thoroughly in its mission, which was to promote the welfare of mankind. If he had any faults they were unknown to me. It seemed to me that in his composition he possessed all the elements which constitute a true man. He possessed in a large degree all those qualities which made him honored and respected by all with whom he came in contact, esteemed by all with whom he had any business relations, and dearly loved by all who knew him as I did. I knew him well; I loved him dearly. Therefore, in accordance with his injunction that I should say but a few words, I will say but very few. I ask that, in your proceedings, it may be stated that your first President stood before you this day to testify to the virtue, to the integrity, to the intelligence, to the amiability, and to the loyalty of one of the best men who has ever been among your number; one of the best and purest men that New York ever knew; one of the most sincere, truthful, genial and cordial men it has ever been my privilege to know. I never heard Major

Dresser utter an immodest word; I can hardly conceive the possibility that he ever had an immodest thought. He was every inch a man. He was an honor to the name of man, and he was an honor to this Association. You will honor yourselves if you set apart a page in the records of your history to his memory as a memorial.

His wife passed from earth to heaven but a few days before it pleased God to call him to follow her upon the same journey. If there is anything in the hearts or minds of men to teach them to believe that the spirits of the just made perfect know what is passing on this earth, then I believe that the spirit of that brave, good, and noble man is permitted to watch over what passes now here among you.

He has children—a son and daughters. He was not a rich man; but the greatest heritage that any man can leave his children is that of an honored name. In that Major Dresser has left to his children a world of wealth.

I respectfully and earnestly ask that that obituary, which was written by some friend of his, and was published in the *Journal*, may be made a part of your proceedings; and it may be safely said that perhaps the oldest man in this business (I do not think the oldest in years), who for nearly half a century has devoted his life to the same object in which you are engaged, stood among you this day to give a heartfelt tribute of affection and respect to the memory of Major Dresser, and asked of you to honor his friend who has passed away, and who was your friend and the friend of mankind. I can say no more.

Mr. Vanderpool—We all agree with what General Roome has said regarding the late Major Dresser, whom I had the pleasure of knowing intimately from the time of his first connection with the interests we represent to the time of his death. Indeed, he was a dear friend of mine. We who were his neighbors in this vicinity feel that there is a void among us that can never be filled. I move that the resolution suggested by General Roome be adopted; that the obituary published in the *American Gas Light Journal* be printed in the proceedings of this Association. And I desire, in addition, to offer the

following resolution with reference to the death of our honorary member Major Dresser, and our Past-President, Mr. W. H. Price:

WHEREAS, The members of the American Gas Light Association have, within the past year, met with an almost irreparable loss by the death of their honorary member, George Warren Dresser, and their Past-President, William Henry Price; therefore,

Resolved, That this Association desires to express the deep sense of sorrow which it feels in the loss of two of its members who, in the strength of their manhood, have been stricken down; both of whom, by their earnestness, ability, and unselfishness, contributed much to the standing and welfare of the gas interests of the country, and who were always present at the meetings of the Association, and were most active in fulfilling its highest aims.

Resolved, That we desire to express our heartfelt sympathy with the relatives of the deceased.

Resolved, That a copy of these resolutions be entered on the minutes of the Association—that a copy of the same be sent by the Secretary to the relatives of the deceased, and that the same be published in the *American Gas Light Journal*.

MR. M. S. GREENOUGH—In rising to second those resolutions, I do it with much hesitation on one account, because it is so difficult to add anything to the eloquent remarks made by General Roome, and to which we have just listened. Still, if resolutions are to be offered in this Association in behalf of Major Dresser, I would not willingly give to another the duty of seconding them. I should consider it, and I do consider it, a privilege to be allowed to speak very briefly to the resolutions which have been offered. There are few members of this Association who have been so fortunate as myself in their intimacy with Major Dresser. It was not for some years after I knew him that I was thrown in close association with him ; but twice, once in your company, Mr. President, and once since, I have had the pleasure of traveling with Major Dresser in other countries, and I there learned to know him, and to ap-

ciate, as I had not done before, what a thorough man, what an honorable gentleman, what a genial, warm hearted friend was underneath the surface which I had previously been acquainted with. In rising to second the motion relative to the memorial of his life, I really feel a strong emotion. I am prepared with no set speech, nor would I deliver it, after the remarks of General Roome, if I had one. I simply wish to say that in losing Major Dresser, the Association has lost a member whose place it will be difficult to fill, and I myself have lost a friend whom it will be impossible to replace.

Mr. Harbison—After what has been said by General Roome and by Mr. Greenough, it seems unnecessary, and, in fact, impossible, to add anything with regard to Major Dresser. We all knew him, we all loved him as a man (and that covers the whole ground), as a gas engineer, and as a friend. I second the motion which has been made by my friend from Newark in regard to the memorial of our beloved past President and friend, William Henry Price. I knew Mr. Price as perhaps no other New England man knew him. I knew him intimately and well. The pleasantest and most profitable hours I have spent, outside of the meetings of the Association, have been during the private talks from time to time at our meetings in various cities, where I have met him. As I have said on my return home, the most profitable (to me) part of my journey has been my personal interviews with Mr. Price. We have sat hour after hour together, after the meetings of the Association had adjourned from day to day, engaged in private conversation. I once made a remark, in a meeting of the Association, to the effect that I aimed for, and believed that I had succeeded in obtaining, the moral support of the consumers of the company which I have the honor to represent. That expression caused a smile upon the faces of many of my associate members of this Association. But Mr. Price saw the undercurrent, and understood what I meant by it, and he manfully came up in the Association meeting and reiterated my statement, and sustained me in my position. That simple action of his formed a link of friendship between us which I could not think of having broken. I looked to him as I would to a

father; and when I had been in difficulties in my business, I have often corresponded with him, and as I have met him have asked him for information and have always received it. Mr. Price was a Christian gentleman in the highest acceptation of the term. He was a devoted husband and father—a father to more than his own family—to every young man of the American Gas Light Association. I feel that it is due to me, personally, as it is also my privilege, to add my humble word of testimony in his behalf, as one of the finest men who has ever been connected with this Association, and one whose place it will be almost impossible to fill. I desire, in addition to what I have said, to move, as an amendment to the resolution of my friend from Newark, that a copy of this resolution, properly engrossed and framed, be sent to the families of our deceased brothers. Perhaps the mover of the resolutions had that in mind. I think one of the greatest prizes these families can have, and one which they will highly cherish, is such an expression of affectionate regard coming from this Association as a fitting tribute to the worth of these two men whom we all loved so dearly, whom we honored and respected so deservedly.

Mr. Vanderpool—I will change my resolution so that it will read in the way suggested by Mr. Harbison—that the resolutions be properly engrossed and framed, and sent to the families of the deceased.

Mr. Hyde—Having for many years been associated with Mr. Price in the Cleveland Gas Company, it is quite proper that I should say something with regard to him, and, at the same time, it is unnecessary for me to speak to you gentlemen who are connected with the American Gas Light Association regarding him, because you all knew him well. He was one of the original members interested in the formation of this Association, and was an active member during all its years, and until his death. You knew him as a judicious and careful president; as a gas man who was thoroughly familiar with the business in which he was engaged; but I knew him in a different capacity. I have not before attended the meetings of the Association, and so I did not know him as a member of this

body; but I have known him well as an employer, as a superior in our business, and in that position I knew him to be a judicious, careful, and competent president of our gas company. Though commencing the business as a new enterprise, as most of the gas men have, he has carefully studied its needs, he has been judicious in all his actions with this body and with his people; and in the management of the business at home he has ever striven to accomplish that which would result in the good of the consumer as well as of the company which he represented. He was a progressive man His idea was to cheapen the price of gas so that it should reach every hamlet, and that the good results to be attained should be attained by increased consumption. As a townsman, he was recognized as a man of superior ability. He was active in public affairs, and has represented his city and county in various offices; always known to the city of Cleveland as a judicious, careful, prudent man, and as one whose advice was always sound and good. He was an honorable, straightforward, and trusted man; and too much cannot be said in his praise. I learned to like him as a genial associate in the gas business. He always greeted me with a smile, and his word was always kind. I always had the utmost respect for him, and shall always retain in my memory the most affectionate regard for him.

Mr. Helme—I do not propose to add anything to what has been already said as to the two gentlemen whom we loved so much and respected so highly. They were well known to all of us. I have never been at a meeting at which they were not both present.

The President—You have heard the resolutions. I trust that it will be the sense of the Association that, in adopting them, the members will rise and unanimously express their appreciation of both of our departed friends.

The resolutions were then unanimously adopted by a standing vote.

PASSING A VOTE OF THANKS TO PRESIDENT FORSTALL.

Mr. Harbison—As our present session is probably the last we shall now hold for the transaction of business, I think that,

at this time, it is due to us as members of the Association, and I feel sure, Mr. President, that it is due to you, as the President of the Association, that before we separate we should express in some way our high appreciation of you, sir, personally, and also of you, sir, as the presiding officer of the Association during the year which is now drawing to a close; and that before adjourning we should place on our minutes some recognition of our appreciation of the intelligent, able, and efficient manner in which you have presided over our deliberations. I therefore move you, Mr. Secretary, that the thanks of this Association be tendered to Mr. Forstall, our President during the past year, for the efficient and gentlemanly manner in which he has presided over our sessions. And I ask that the vote be taken by rising.

The resolution was unanimously adopted by a standing vote.

THE SECRETARY—Mr. President, I beg to inform you that by a unanimous vote this Association tenders you its hearty thanks, for the able and impartial manner in which you have presided over its deliberations.

THE PRESIDENT—Gentlemen of the Association: No one in this room can feel more keenly than I do how far short I have fallen of the position that your President ought to occupy. If I had been made of sterner stuff, I think there would have been much more reason for the resolution which my friend Mr. Harbison has moved. I feel that I have only done half my duty; and for your kind appreciation of what little I have done, I beg sincerely to thank you.

NATURAL GAS.

MR. HARBISON—I believe that it was understood this morning, but it had escaped my mind for a moment, that our friend, Mr. Hequembourg, of Bradford, Pa., was going to tell us something about natural gas, and we all should very much like to hear from him now.

MR. A. C. WOOD—I think that Mr. Hequembourg is not here; and, if he were, he is not prepared, at this time, to give to the Association any facts or figures with regard to natural gas. He

will be prepared to do so at the next meeting of the Association. From time to time at our meetings this question of the use of fuel gas has arisen. A few years ago Mr. Vanderpool, of Newark, read a very interesting paper upon that subject, I think before the Society of Gas Lighting, in which he showed from careful experiments and accurate tests, the relative value as between gas and coal for fuel purposes, the making of steam, and otherwise. At a meeting of the Central New York Association, a paper was read by Mr. Dunning, of Auburn, as to his experience in heating his dwelling by this means. Mr. Hequembourg, of the Bradford Gas Light Company, which, as you know, uses natural gas, has had a large experience in this direction, and has sent out more gas for heating purposes than any other man in the world; and he will be prepared in another year to give us some very interesting facts and figures in that regard. To-day he could only give you the relative value of this natural gas and coal; and I will state in an incidental way, that it requires from 35,000 to 40,000 cubic feet of natural gas to obtain the same heating power as would be gained by the use of one ton of coal, or as the equivalent of one ton of coal. He proposes, during the coming year, to have that natural gas analyzed, and further experiments will determine its relative value as compared with coal, water, or oil gas, and the paper which he promises to give us will be very interesting. I move that Mr. Hequembourg be requested to furnish the Association with such a paper at its next annual meeting.

The resolution of Mr. Wood was unanimously adopted.

DISCUSSION ON VARIOUS TOPICS.

MR. SLATER—I move that the Committee of Arrangements having in charge the next annual meeting, be instructed to make an arrangement to have the dinner for the members of the Association on the evening of the second day of the meeting; and that the expense of the entertainment be assessed upon all the members present.

MR. SMEDBERG—I move, as an amendment, that all arrangements respecting the dinner be left to the Committee of Ar-

rangements, with full power to act as in their discretion they may deem best.

The amendment was agreed to and the resolution as amended was adopted.

Mr. Harbison—I call upon the new Secretary and Treasurer to come forward and show himself, in order that we may know what manner of man he is.

The Secretary-elect, Mr. Humphreys, came forward, and was introduced by the retiring Secretary.

Mr. White—Gentlemen of the Association. It is my pleasant duty to present to you Mr. C. J. R. Humphreys, the Secretary and Treasurer-elect; I bespeak for him the same kind courtesy with which you have met all my efforts to transact the duties of my position; and I assure Mr. Humphreys of my hearty support, and that the aid of my personal experience in this office is at his command now and always. (Applause.)

Mr. Humphreys—Mr. President, and Gentlemen: I wish to tender my sincere thanks to you for the honor you have conferred upon me in selecting me to be the successor of my good friend, Captain White; and I promise you that if the duties of the office are not properly performed in the coming year, it will be for want of ability, and not for want of any earnest efforts on my part. I am sincerely obliged to Captain White for his very kind profer of assistance.

Mr. Page—Our Secretary has been for a long time the American correspondent of the London *Journal of Gas Lighting*. I mention this, thinking that it may not be known, generally, to the members.

Mr. Vanderpool—I wish, as Chairman of the committee on the addresses of Presidents Hickenlooper and Forstall, to make report that the committee have had a meeting, and have organized. They have partly considered the matters presented. and find it impossible to make a satisfactory report at this meeting. The subjects presented are such as to require a great deal of attention with respect to very many details. We have concluded, with the consent of the Association, to con-

tinue the organization of the committee, and, during the year, to put ourselves in communication with the principal companies in the country, and ascertain whether they are ripe for some such organization as has been suggested. We hope at the next annual meeting to be able to make a full and satisfactory report.

MR. PRESIDENT—Mr. Pearson has recently tried, at Toronto Canada, to stimulate the use of gas by an interesting exhibit of stoves and other apparatus connected with the consumption of gas. Perhaps a short account from him of that exhibit would be interesting, and we would be glad to hear from him.

MR. PEARSON—I do not think that there is any necessity for my attempting to give any detailed account of our exhibit. This much, however, I may say—that the success of the exhibit entirely exceeded my most sanguine expectations. The idea originated with me that it would be a very good thing to try, and for several reasons. In the first place, I was thoroughly satisfied that the claimed 2,000-candle power for electric lights was a fallacious one. I had seen some very large gas burners, and I was quite satisfied that 500, 600, or 700 candles in Bray or Siemens burners would exceed any electric light that I had ever noticed, at all events so far as the diffusion of the light was concerned. One thing that our exhibit did was this: it thoroughly demonstrated the fact that the claim for high candle power for the electric light was altogether fallacious. It also fully established the fact that the diffusion of light from a gas burner, of far less claimed illuminating power than that claimed for the electric light, was very much greater. I also felt satisfied that if our consumers only knew the value of gas as a cooking and heating agent, as well as for motive power, it would result in a very large increase of that class of consumers. In that respect my anticipations have been more than realized. I have a larger number of applications for the various kinds of gas stoves, and a larger number of applications for gas engines, at this time, than we have ever had during any similar period at any time of the year. And this has been brought about simply because the people were able to see for themselves

the utility of gas for heating and cooking purposes. It is rather a difficult thing to get anybody to come to your office to examine gas stoves. I have issued circulars, time after time, with only a fair degree of success. But when people go to an exhibition and see for themselves the various articles shown they will, of course, also take notice of such articles along with the various other exhibits. I found that their seeing for themselves the gas stoves in the practical operation of cooking had a marvelous effect in changing their opinion with regard to the value of gas for that purpose. In some other respects our exhibit has also been very advantageous. For instance—I had one of the old fashioned gas burners placed over a test meter. The meters were stamped by the Government Inspector, so that anybody could see that they were correct. By the side of the old fashioned burner I had a good burner, and underneath them I placed a card saying, "These burners are consuming the same amount of gas. Examine them for yourselves." The exhibit had a good effect. It has shown our consumers that a good many of the complaints which they make about their gas was not owing to its need of illuminating power, but to the medium through which that gas was supplied. I did the same thing with regard to globes. I got a modern globe, with a 4-inch opening at the bottom, and by the side of it I placed an old fashioned globe, with almost closed openings, and I called attention to the difference in the steadiness of the light, comparing one globe with the other. I might enlarge upon the different points of the exhibit, but I do not think it necessary for me to say anything further. I can heartily recommend to the members of this Association, if they can get up a similar exhibit in their various localities, to do so. If it even costs you some thousands of dollars, if you are in a large city, I am satisfied that the exhibit will pay you in the course of a year or two over and over again. But I do not see why the Association itself should not take the matter up, and at the next meeting invite the various manufacturers to exhibit their gas engines, their gas stoves, and other things in competition. I do not see why you should not do this, and give us an opportunity to examine for ourselves the very best articles that can be had,

and also have them on exhibition where the public can see them, and determine for themselves as to their utility. I throw out the suggestion as a practical one, and I think that if it could take some such shape it would be a very desirable thing for the gas interest in our country. I forgot that I was on the other side of the line. (Laughter.) It may be "our country" some day ; I do not know. (Applause.)

MR. SMEDBERG—With regrad to Mr. Pearson's idea, when the *American Gas Light Journal* was first started, Mr. Murray purposed a sort of exhibition at a central hall, where all objects interesting to gas consumers might be exhibited ; but the thing fell through. It only shows how two great minds think alike.

On motion of Mr. Harbison, the Association then adjourned *sine die.*

TWELFTH ANNUAL MEETING

OF THE

AMERICAN GAS LIGHT ASSOCIATION,

Held at Willard's Hall, Washington, D. C., Oct. 15, 16, and 17, 1884.

FIRST DAY, MORNING SESSION—WEDNESDAY, OCT. 15.

The Association was called to order at 10 o'clock, by the President, Col. Wm. A. Stedman.

The reading of the minutes of the last annual meeting was, on motion of Mr. Sherman, dispensed with, as they had been published in the *American Gas Light Journal.*

ROLL CALL.

Upon calling the roll the following members were found to be present:

ACTIVE MEMBERS.

Allmand, Charles S.,	Norfolk, Va.
Andrew, John,	Chelsea, Mass.
Anderson, J.,	Cincinnati, Ohio.
Atwood, Henry A.,	Plymouth, Mass.
Balmore, John,	New York, N. Y.
Bates, John W.,	Hoboken, N. J.
Battin, Isaac,	Albany, N. Y.
Baxter, Wm. H.,	Petersburg, Va.
Beal, Wm. R.,	New York, N. Y.
Breese, E. M.,	Detroit, Mich.
Butterworth, Thomas,	Rockford, Ill.
Burtis, P. T.,	Chicago, Ill.
Baumgardner, J. H.,	Lancaster, Pa.
Baxter, Robert,	Halifax, Nova Scotia.
Baxter, Isaac C.,	Evansville, Ind.
Booth, Charles E.,	New York, N. Y.

Bush, Jno. S , . . .	New York, N. Y.
Bauer, P., . . .	Washington, D. C.
Cabot, George D., . .	Lawrence, Mass.
Cadwell, Wm. D., . .	Nashua, N. H.
Cartwright, J., . . .	Fishkill-on-H's'n, N.Y.
Cartwright, Matt., . .	Rochester, N. Y.
Cartwright, William, . .	Oswego, N. Y.
Coggshall, H. F., . .	Fitchburg, Mass.
Cornell, Thomas C., . .	Yonkers, N. Y.
Cowing, John H., . .	Buffalo, N. Y.
Crafts, David W., . . .	Northampton, Mass.
Curley, Thomas, . .	Wilmington, Del.
Cabot, Jno., ...	Lawrence, Mass.
Collins, A. P., . . .	New Britain, Conn.
Coyle, Patrick, . . .	Charlestown, Mass.
Corbett, Charles H., . .	Brooklyn, N. Y.
Cressler, A. D., . . .	Fort Wayne, Ind.
Connelly, T. E., . . .	Pittsburgh, Pa.
Davis, F. J., ...	Boston, Mass.
Denniston, W. H., . .	Pittsburgh, Pa.
Diall, M. N., . . .	Terre Haute, Ind.
Dickey, R. R., . . .	Dayton, Ohio.
Down, W. H., . . .	New York, N. Y.
Dingee, F. A., . . .	Philadelphia, Pa.
Edgerton, H. H., . . .	New Orleans, La.
Floyd, James R., . .	New York, N. Y.
Fodell, W. P., . . .	Philadelphia, Pa.
Fowler, John, . . .	Philadelphia, Pa.
Flemming, D. D., . . .	Jersey City, N. J.
Floyd, Fred. W., . .	New York, N. Y.
Findley, Jno. H., . . .	Ogdensburgh, N. Y.
Gardner, William, . .	Pittsburgh, Pa.
Gates, Frederick W., . .	Hamilton, Ont.
Gilbert, T. D., . . .	Grand Rapids, Mich.
Goodwin, W. W., . . .	Philadelphia, Pa.
Greenough, Malcolm S., .	Boston, Mass.
Guerard, A. G., . . .	Savannah, Ga.
Griffin, John J., . . .	Philadelphia, Pa.

Geggie, David H.,	Quebec, Can.
Gerould, Charles L.,	Manchester, N. H.
Gardner, James R.,	Pittsburgh, Pa.
Gribbell, Jno.,	New York, N. Y.
Hanford, L. C.,	Norwalk, Conn.
Harbison, John P.,	Hartford, Conn.
Helme, William,	Philadelphia, Pa.
Hookey, Geo. S.,	Augusta, Ga.
Humphreys, Alexander C.,	New York, N. Y.
Humphreys, C. J. R.,	Bergen Point, N. J.
Hequembourg, C. E,	Bradford, Pa.
Hyde, G. A.,	Cleveland, Ohio.
Hallet, J. L.,	Springfield, Mass.
Isbell, Charles W.,	New York, N. Y.
Jones, S. Lewis,	Philadelphia, Pa.
Knowles, J. H.,	Richmond, Va.
Kraft, Geo. W.,	Philadelphia, Pa.
Kuehn, J. L.,	York, Pa.
Lindsley, Edward,	Cleveland, Ohio.
Littlehales, T.,	Hamilton, Ont.
Ludlam, Edwin,	Brooklyn, N. Y.
Leach, H. B.,	Taunton, Mass.
Lynn, J. T.,	Chattanooga, Tenn.
Langford, John S.,	Newtown, Mass.
Lowe, Leon P.,	Philadelphia, Pa.
Monks, Richard J.,	Boston, Mass.
Morris, H. G.,	Philadelphia, Pa.
Merrick, Samuel V.,	Philadelphia, Pa.
McCauley, L. G.,	West Chester, Pa.
McElroy, John H,	Pittsburgh, Pa.
McIlhenny, G A.,	Washington, D. C.
McIlhenny, John,	Philadelphia, Pa.
McMillin, Emerson,	Columbus, Ohio.
McDonald, William,	Albany, N. Y.
McCullough, E. H.,	Philadelphia, Pa.
McDougal, John,	Hornellsville, N. Y.
Neal, George B.,	Charlestown, Mass.
Nettleton, Chas. H.,	Derby, Conn.

Norton, A. M.,	Nashua, N. H.
Pearson, W. H.,	Toronto, Ontario.
Prichitt, Samuel,	Nashville, Tenn.
Pratt, J. C.,	Jamaica Plain, Mass.
Page, George S.,	New York, N. Y.
Parrish, W.,	Seneca Falls, N. Y.
Perkins, James D.,	New York, N. Y.
Prichard, Chas. F.,	Lynn, Mass.
Rogers, James F.,	Jamaica Plain, Mass
Rowland, T. F.,	Greenpoint, N. Y.
Richardson, F. S.,	N. Adams, Mass.
Sherman, F. C.,	New Haven, Conn.
Slater, A. B.,	Providence, R. I.
Smith, C. F.,	Havana, Cuba.
Smith, Marcus,	Wilkesbarre, Pa.
Stanley, I. N.,	Brooklyn, N. Y.
Starr, James M.,	Richmond, Ind.
Stedman, William A.,	Newport, R. I.
Stiness, Samuel G.,	Pawtucket, R. I.
Smedberg, James R.,	Lancaster, Pa.
Stein, E.,	Philadelphia, Pa.
Sprague, Chas. H.,	Boston, Mass.
Smallwood, James B.,	Baltimore, Md.
Sheldon, H. H.,	Providence, R. I.
Smith, R. A. C.,	New York, N. Y.
Turner, Thomas,	Charleston, S. C.
Tufts, Nathaniel,	Boston, Mass.
Thomas, Jos. R.,	New York, N. Y.
Vanderpool, Eugene,	Newark, N. J.
White, Wm. Henry,	New York, N. Y.
Williams, James,	Johnstown, Pa.
Wood, Austin C.,	Syracuse, N. Y.
Whitney, Step. W.,	Albany, N. Y.
Weber, O B.,	New York, N. Y.

NEW MEMBERS.

Applications for membership from the following gentlemen were read by the Secretary:

Adams, Wm. C.,	Richmond, Va.
Blodgett, Charles W.,	Brooklyn, N. Y.
Boardman, A. G.,	Macon, Ga.
Clark, Walton,	New Orleans, La.
Connelly, I. S.,	Pittsburgh, Pa.
Fay, Wm. J.,	Denver, Col.
Flanegen, C. D.,	Athens, Ga.
Hoover, C. E.,	Winchester, Va.
Hayward, Thomas J.,	Baltimore, Md.
Leavitt, Hayward G.,	New York, N. Y.
Lane, Wm. M.,	Lancaster, Pa.
Loomis, Burdett,	Lynn, Mass.
Mayer, Frederick,	Baltimore, Md.
O'Brien, Wm. J.,	Philadelphia, Pa.
Simpkin, Wm.,	Richmond, Va.
Townsend, S. S.,	New York, N. Y.

On motion of Mr. S. G. Stiness the Secretary was directed to cast the ballot of the Association for the election of the applicants. Messrs. M. S. Greenough and D. D. Flemming were appointed tellers, who reported that the foregoing gentlemen were unanimously elected members of the Association.

The newly elected members were then introduced to the convention by the President.

REPORT OF COMMITTEE OF ARRANGEMENTS.

Mr. William Helme, on behalf of the Committee of Arrangements, reported that the Committee had arranged the following programme for the meeting; and they had also accepted with thanks the invitation of the Washington Gas Light Company for the entertainments noted on the programme:

PROGRAMME.

Wednesday, October 15.—10 o'clock, A. M.—Meeting called to order by the President; Reading of Record; Election of new

members; Address by the President; Report of Executive Committee; Treasurer's Report; Report of Finance Committee; Reports of Special Committees; Election of Officers; General Business. 12:30 to 2 o'clock, P. M.—Recess; collection of dues at Secretary's office after morning session. 2 o'clock, P. M. —Re-assembling; reading of papers and discussions; roll call. 6 o'clock, P. M.—Adjourn.

Thursday, October 16.—9 to 10 o'clock, A. M.—Tickets for banquet and excursion, to be obtained at Secretary's office. 10 o'clock, A. M.—Meeting called to order; reading of papers and discussions. 12:30 to 2 o'clock, P. M.—Recess. 2 o'clock, P. M.—Re-assembling; reading of papers. 6 o'clock, P. M.—Adjourn. 8 o'clock, P. M.—Banquet.

Friday, October 17.—9 o'clock, A.M.—Meeting called to order. 9:10 o'clock, A. M.—Omnibuses will be at hotel for accommodation of members wishing to visit the Gas Works. 11 o'clock, A. M.—Leave Gas Works for Seventh street wharf. 11:30 o'clock, A. M.—Take special steamer *Mary Washington*, at Seventh street wharf, for Mount Vernon. 3:30 o'clock, P. M.—Steamer leaves Mount Vernon, arriving in Washington 5:30.

MR. S. G. STINESS—It seems to me that it would be nothing more than courteous for the Association to formally accept the invitation of the Washington Gas Light Company, and also to formally tender them our thanks for their kindly remembrance of our Association upon the occasion of our meeting in the city of Washington. I therefore move that we accept the tender of the hospitality of the Washington Gas Light Company, and extend to them our hearty thanks for their kindly recognition of our presence in their city.

MR. M. N. DIALL—I take great pleasure in seconding that motion.

THE PRESIDENT—Such a motion is eminently proper, and I know that it meets the hearty concurrence of every member. I take very great pleasure in putting the motion of Mr. Stiness.

The motion was unanimously adopted.

PRESIDENT'S ADDRESS.

President Stedman then read the following address:

Gentlemen of the American Association: — The returning autumn brings us again into this harvest field of ripe experience to garner into memory's storehouse the rich yield of practical knowledge and demonstrated truth, with which our promised papers are doubtless replete; and to glean the grains of fruitful suggestion which are scattered through our discussions. The earnest harvesters are here, intent on acquisition, and ready to do their part to make ample returns for the good they receive. Let us hope that all present are very much in earnest, and that promptness in assembling at the appointed hour, and eagerness to listen to all the proceedings, even should they at times seem a little prosy, will be marked features of this meeting. And let a spirit of polite consideration for the speakers and for those who would be listeners, do away with the exasperating buzz and hum of conversation, which at meetings heretofore have invidiously distinguished the back seats. We must all do our part to make and maintain order. None would voluntarily be guilty of a discourteous act, particularly toward a member of the Association. And so it is only thoughtlessness that allows one to lapse into the eminently impolite and embarrassing side talk, which unconsciously swelling in volume, as in earnestness, rises to a positive interruption. Quiet and attentive hearers are as much a necessity to the success of the meeting as interesting speakers; and let me remind you that each and all are to contribute to the success of the meeting whether you take the *role* of essayist or add to the general enlightenment by taking part in the discussions, or if you are simply the pleased and interested auditor whose beaming face inspires the speaker. They also serve who sit and keep quiet.

In looking over the field of practical work no startling discovery illuminates any particular point; but in every direction there seems to have been hearty effort and continuous and intelligent progress. The business of electric lighting has about outlived its value as a speculation, and it appears now

to be settling down to the more prosaic work of earning, or trying to earn, dividends. It has been shorn of the blandishments by which the guileless investor was taken in; and it is no longer invested with the terrifying features which robbed the gas shareholder of his slumbers. Of late the attention of inventors is turned toward the development of electricity as a motor. Confidence in the permanence of gas for illumination is restored, and we no longer have to regard the possibility that our chief product may be relegated to the simple purposes of heating and cooking. However much these latter applications are desirable in connection with our present business, it was not cheering to feel that we might be crowded down and out from the more esthetic application.

Every step we take in the direction of cheapening the cost of gas is a step further from danger of rivalry. A retrospect of ten years will give encouragement. Take your manufacturing books and see, first, how many cubic feet you have gained from the carbonization of a ton of coal; next, how much the fuel account has been reduced; then see how, by judicious arrangement and management, the life of retorts and settings has been prolonged, and the production of gas from each retort has been increased, not only for the per diem account, but in the aggregate of total production; consider how manual labor has been reduced by the devices in substitution for bone and muscle; finally, take the cost of gas in the holder, as compared with the cost ten years ago, making due allowance for difference in prices of materials, and I am sure you will have cause to look forward hopefully, because we are not yet at the end of the avenue of progress. What has been done will be far surpassed by what is already in the germ ready for the practical intelligence which shall quicken it into perfect development.

Attention all over the gas making world has been engaged during the past year in perfecting the application of regenerative firing to furnace work. Our English friends have apparently made up their minds on this subject, and are hastening its introduction into their retort-houses. In this country the subject is receiving much attention, and many styles of construction have been employed. This rational and scientific method

of heating our retorts makes an exceedingly fruitful subject for discussion, and doubtless will receive a due share of your attention.

No one has yet secured an additional foot of gas per pound of coal over the standard of last year, as far as I have heard. It is in order now to advance in the matter of yield per pound, as no decided gain has taken place within the last few years. It is within recent memories that 4.25 was the orthodox result, and suspicion attached to statements of any considerable increase over these figures. We overcame the difficulties in the upward path to five feet; but about here we seem to have paused, for beyond is the domain of stopped stand-pipes, pitchy mains, naphthaline, gas so attenuated as to require much strengthening, and altogether so much trouble and uncertainty as to render a slight gain of doubtful value. No step we could take would do more to cheapen the production of gas than to materially increase the yield. Who steps forward to lead us around all these obstacles and point the safe road beyond? We are promised a specific for stopped stand-pipes. We have already at our own service an hydraulic main which can be thorougly cleaned without stopping the make. We want only more refractory retorts and fire materials, and a guarantee against naphthaline, to warrant us in attempting the achievement of another foot. There is a good deal more possible gas in the coal than we get out of it, and we do not despair of approaching nearer to thorough work than we stand to-day.

Regenerative firing is making a revolution in the building of retort-houses. About all the new constructions have the furnace floor at the ground level. This arrangement gives plenty of ventilation, ample space for working the furnaces, and the collateral advantages in taking care of the coke and reducing its handling are evident. The sole apparent drawback is the cost of elevating the coal to the charging floor ; but this cost is so small as not to weigh against the manifest advantages. With the firing of the furnace, done simultaneously with the drawing of the charge, and the rest of the coke dropped below, the work of the stokers is reduced, and the helpers on the charging floor almost dispensed with. Below the coke is quenched and

loaded into wagons at once when the sales are brisk ; or, if the coke is to be crushed and prepared for market, suitable devices for handling it are provided. A large number of furnaces are taken care of by one man ; so that the make of gas per man, including all about the retort-house, should be very large. With a good sale of residuals, the cost of gas in the holder will be a figure that will confirm the confident statement that coal gas is the light of the future.

When we have entirely outgrown the traditions which enthralled us previous to our society formations, we shall give each other the benefits of our figures in a way to make comparisons of results something more definite than close guesses. The gas sold per ton during a year ; the bushels of coke sold ; the gallons of tar and ammoniacal liquor, and what were the receipts from each. Or, leaving out the money value, it is evident we could hardly compare results to such advantage in any other way. Sometimes we obtain for a period of favoring conditions extraordinary results, and we naturally speak of them rather than about the accompanying drawbacks. We do this, perhaps, more from the unconscious desire not to burden our auditor with a tale of trouble than to impress him with our success. But we ought really to tell the whole story, however it may pain him to hear it, because it may save him from disaster, and he may know the remedy we need to obviate our drawbacks. The bottom lines of a year's work, wherein disadvantages and advantages have offset each other, and wherein our hopes and expectations are balanced against the materialism of federal money, are instructive to contemplate. We are told that materials cost so much and labor so much, and hence cost of gas in the holder is so much. It is not worth while to gainsay the statement ; but we know how many items are to be added in, and how, despite our endeavors, these will intrude to swell the cost of production and delivery. Any process which would evade them would be a great success. But a mere statement of cost of materials and labor, however seductive to the investing public, or even to the average director, fails to convince the gas engineer. Bring the manufacturing accounts of the different processes side by side, compare item with item, and let

the verdict rest on the *whole* truth. We are called conservative and incredulous ; but the whole story, practically proved, will bring conviction where partial statement, with much reservation, will fail.

We ought to be able to ascertain the exact truth about the different processes at this meeting. We have representatives here who could give us the minutest figures of daily work. The yield per ton of gas, coke, tar, etc., under good working conditions, is perfectly well known. The receipts from residuals, or rather the quantities of residuals, left for sale are not so well agreed upon. But we need to have clear and explicit statements of the best obtainable results from several different processes, so that we can take home, to our desks to figure on the statistics, impartially given, by those whose position enables them to state from experience the advantages and disadvantages of some of the "improvements in the manufacture of gas," of which we hear so much, and about which we can learn so little. Make the facts which each has acquired the common property of all.

Some one says that the clock, the scales and the two foot rule are the emblems of civilization. They are certainly potent factors in the advancement of science and the enlightenment of the world. In our own business I am sure we are all impressed with the importance, in a general way, of accurate gauging of our work and progress, and of speaking from exact knowledge in our discussions. A careful record of daily operations, in detail, involves much care and watchfulness to avoid errors which would make our seeming results but delusions. And yet, aside from the general value of accurately ascertained facts, and their importance in practical investigations, a careful record and close study of them often opens the way to great discovery. But we may well be modest in generalizing from our seeming facts. It is hardly worth while, if our conclusions seem to indicate that previously accepted laws are not in accord with our results, to hasten to refute the theories which an age has accepted as truth, or proclaim that we have made a discovery which transcends physical law. The recent blue glass craze was founded on the acceptance by the unthinking and

unreasoning multitude of a statement the correctness of which, and the tests and demonstrations whereof, were certified by great numbers whose love of the marvellous outran their respect for law. Of late their has arisen an English philosopher whose rather mixed reasoning convicts him of a not too careful study of the philosophy he attempts to expound, and who makes the dogmatic assertion that "air cannot be heated at atmospheric pressure." He is very much in earnest, and goes to the trouble of illustrating, in his article recently published, the experiments by which he has convinced himself. With amusing egotism he asserts the new doctrine, and challenges contradiction. It was not very surprising that one single experimenter, with a superficial knowledge of the physical laws relating to his subject, should have gone astray, as he evidently did, from too hasty conclusions; but it was surprising and rather exasperating to find that he had many supporters of his theory, and that even the editor of the London *Journal* should state that no one had disproved these startling assertions. Indeed, the *Journal* seemed to give *quasi* support to the doctrine. Now, it is perfectly well known that dry and pure air allows rays of heat to pass through it without any access of temperature; it is just as well known that air at ordinary pressure is heated with great facility by bringing it in contact with highly heated solid substances. After the subject had been discussed in several consecutive numbers of the *Journal*, and the author of the new theory had rather contemptuously rejected the refutations of the few physicists who condescended to notice the discovery, a crucial test is made, in a manner which admits of no dispute, and the pyrometer registers 975°. It would seem that a very simple experiment would convince one of the ability of air to take up heat, even in passing at great speed over hot surfaces. Remove a sight-hole plug from a flue where the hot, spent gases are passing, and observe how the ingoing air almost instantly blackens the white-hot tiles.

An admirable service rendered by our meetings is in the opportunity afforded to consult together about just such apparent discrepancies between established theories and our sometimes inexplicable experience. The confirmation of cor-

rect conclusions and the dissipation of erroneous assumptions is offered here to him who modestly seeks after truth rather than notoriety.

When, in former times, the lust of gold led men to roam the seas in search of plunder, and privateers came into port laden with the spoils of piracy, the allurements of sudden acquisition of wealth so stimulated desire that the ocean swarmed with legalized robbers, and success quieted scruple. But after a time no ship was safe ; no enterprise could be secured against the hazard of plundering freebooters of the sea. Capital, which had provided the outfits for the marauders enlisted in its service of spoliation, stood aghast at the logical outcome of its teachings and example. The pirates increased till they almost outnumbered the ships of peaceful trade, and the enlisted robbers even ignored the tradition of honor among thieves, and confiscated the property of their employers. Then the latter bewailed the dishonesty of the world, and an international agreement put down piracy upon the high seas.

Now the freebooters operate upon the land. Legislation is apathetic, while the craft and cunning of greed imposes upon communities, and robs the rich and poor indifferently of honest accumulation or scanty savings. Conscienceless and pitiless, vaunting its power and unscrupulousness, combined capital is seeking to destroy, by methods not more moral or reputable than the old-time pirates employed, the investments which in many cases are almost the sole reliance of those for whose protection the law ought to be effectually invoked.

How long these raids on property will be tolerated, and how much longer communities will be blind to their own interests, and legislators will fail to discriminate between the honest claims of their own constituents and the specious pretences of adventurers, no one can now foresee. But just as freebooting on the seas became intolerable, so will this land piracy be eventually suppressed, as the mutual destruction wrought by contending capital will be seen, not the blessing which it is claimed to be, under the beguiling name of competition, but the unmixed evil which comes from the destruction of property, or from rendering it wholly or partially unproductive.

The constant and widespread agitation on the subject of gas supply, and the consequent enlightenment of the public in regard to the character of the business, as well as the frequent exposure and defeat of blackmailing and fraudulent schemes of many of the so-called "gas improvement companies," all tend toward the inevitable result, which, whether it come sooner or later, must eventually come—and that is the regulation of gas supply, and the guarantee of protection to investments honestly made in the business.

My predecessor in this chair last year concisely stated the advantages to be derived from governmental regulation. I wish to urge upon this meeting a reconsideration of this subject, as he presented it, and to take action to hasten the adoption of the measures recommended by him. The news of a decided move in the right direction comes from the city of Boston, where Alderman Greenough has proposed, and the proposition has been adopted, that the Legislature be asked to establish a gas commission. This comes from the right quarter; and the honor of the first just conception of the mutual obligations between communities and the gas companies who serve them, and of an intelligent and equitable adjustment of those obligations, will probably belong to a Massachusetts Legislature.

There is another subject which was called to your attention by President Hickenlooper at Pittsburgh, and upon which a preliminary report was made last year by the special committee thereon. I quote his presentment of it:

"Concentrated action should be made to take the place of the very numerous and costly experiments independently made and many times repeated."

How many of us have been over ground which already had been fruitlessly and disappointingly explored. We certainly have the means, or can command them, to acquire and maintain an expert committee, to whom should be referred the solution of questions which would baffle independent and isolated investigations, and which such committee could determine authoritatively. The confusion in the system of weights and measures in use in English speaking countries is such that

we do not understand each other when we speak together. The fixing of an absolute standard of uniformity, by the committee, for our use, would go far to clear up ambiguity of statement; and the reference to them, for experiment and report, of mooted topics would shorten up many prolix contentions which unprofitably consume the time of our conventions.

Not the least valuable service which the committee of experts could render, and which their experience would enable them to make very complete, would be the formulation of a system of manufacturing accounts, which should be the standard for statement and comparison of results. Also rules for the assignment of the cost of labor, so as to have uniformity of method in its division between the different departments. While there may remain, among the less intimate acquaintances of this larger Association, a natural reserve about making full revelations of all one's business, uniformity of accounts would be a blessing to the local associations, the members of which compare notes with great freedom and minuteness of detail.

How profound would be the relief, when new processes were forced upon our attention, to ask of their promoters a certificate from our referees that all the assertions set forth by seductive circulars or beguiling parole were verily reliable and trustworthy. It might be difficult to select the committee we need from among our members, since these are generally too occupied with their own business to give the prolonged and continuous attention requisite to make technical investigations. We can recall the memory of a committee appointed many years ago to report on the processes of oil gas manufacture, which were then receiving the unqualified commendation of those engineers who had them in use. The committee did not arrive at any conclusion, although the processes did. And hence we see that such service as a proper investigating committee would give cannot be commanded gratuitously. Indeed, its cost and incidental expenses might surpass our ability as an association to pay. But the knowledge gained and the decisions reached would be of great value to the companies we represent, and few ot them would refuse the small assessment, which, rated on the business done, would be insignificant. I sincerely trust

that in the near future we may have a board of expert referees, who shall decide for all of us, at once, the vexatious questions of the relative economies of different materials or different methods. No discussions and comparisons among ourselves of our own work and results could so rapidly advance our knowledge and clear up contending hopes and doubts.

And now, gentlemen, I rely on the individual efforts of each and the cordial co-operation of all, to create and sustain an animated interest at every session. We are promised papers whose titles indicate their importance; and our discussions will be, I hope, thorough and to the point. In addition to the topics of the essayists there are many subjects which arise in the minds of members whereon light is desired. A very interesting feature of our last New England meeting was the opening of the question box, followed by the answers and comments resulting from the queries which were taken from it. If any member would like any particular subject discussed, or has a question to ask, if he prefers to bring it before the meeting in writing it will receive attention at the proper time.

With the sincerest appreciation of your favor in calling me to this position, and trusting to your forbearance with my errors, I indulge the hope that this meeting will be pleasantly remembered for the profit and pleasure it will bring to every member of the Association.

REPORT OF THE EXECUTIVE COMMITTEE.

MR. M. S. GREENOUGH, Chairman of the Executive Committee, presented the following report, which was read by the Secretary, and, on motion of Mr. W. H. White, adopted:

WASHINGTON, D. C., Oct. 14, 1884.

To the Members of the American Gas Light Association:

GENTLEMEN:—Your Executive Committee would respectfully report the following acts and recommendations for your approval:

The hours for holding the sessions during the present meeting to be as follows: Wednesday, meet at 10 A. M., adjourn at

12:30; reconvene at 2 P. M., adjourn at 6 P. M. Thursday, same hours. Friday, meet at 9 A. M., and hold subject to vote of Association.

Recommend that the Secretary be instructed to proceed with the publication of Volume VI. of the Association's transactions; that he have 700 copies printed, and send two copies to each member.

Recommend that the salary of the Secretary and Treasurer for the ensuing year be fixed at $500, and his actual expenses in attending the meetings of the Association.

The following papers have been approved, and will be read at the meeting: "The Relation of Capital to the Output," by Thos. D. Gilbert; "Periodical Testing of Consumers' Meters," by C. H. Nettleton; "Natural Gas," by C. E. Hequembourg; "Valves *vs.* Centerseals for Working Purifiers," by S. G. Stiness; "Gas Stoves a Means of Revenue," by R. B. Taber; "Iron Sponge for Purifying," by H. F. Coggshall; "A Positive Cure for Choked Standpipes," by S. G. Stiness; "Registry of Meters," by E. McMillen; "Coating Gas Mains with Coal Gas Tar," by G. A. Hyde; "Notes on Chemistry of Gas Making," by E. McMillin.

M. S. GREENOUGH,
For the Executive Committee.

REPORT OF FINANCE COMMITTEE.

Mr. JOHN ANDREW, Chairman of the Finance Committee, read the following report:

The undersigned, members of the Finance Committee, have examined the accounts and books of Mr. C. J. R. Humphreys, Secretary and Treasurer, for the year ending September 30, 1884, and find the same to be correct in every particular.

JOHN ANDREW,
GEO. S. HOOKEY,
WM. CARTWRIGHT,
Finance Committee.

On motion of Mr. William Helme the report was adopted

REPORT OF SECRETARY AND TREASURER.

The Secretary and Treasurer (Mr. C. J. R. Humphreys) read the following report, which was, on motion of Mr. S. G. Stiness, accepted and placed on file:

NEW YORK, September 30, 1884.

Receipts.

From initiation fees, . . .	$430 00	
Dues, year 1881, . .	15 00	
" 1882, . . .	135 00	
" 1883, . . .	295 00	
" 1884, . . .	810 00	
" 1885, in advance,	35 00	
Interest on funds of Association,	64 80	
Total receipts, .	$1,784 80	
Cash brought forward from last year, . . .	1,448 64	
To account for, . . .		$3,233 44

Expenses.

Salary of Secretary and Treasurer,	$500 00	
Expenses New York meeting,	169 55	
Amount paid James R Floyd for hospital expenses, David Douglas, ...	100 00	
Printing and stationery, .	79 50	
Engrossing two sets of resolutions,	30 00	
Petty cash, ...	90 91	
Total expenses, .	$969 96	
Cash carried forward to year 1884-85, ...	2,263 48	
		$3,233 44

Memo. of cash on hand—

Deposit in South Brooklyn Bank, .	$1,154 27
Deposit in Williamsburgh Savings Bank,	1,039 30
Cash in Treasurer's hands, . . .	69 91
	$2,263 48
Due from members, including annual dues for 1885, ...	$1,770 00

The roll of membership for the year shows as follows:

Active.

Members on roll October 1, 1883, .	241	
Members admitted, New York meeting,	43	
		284
Members died during year, . .	2	
Members dropped during year, .	10	
Members resigned during year, . .	1	
	13	
Number now on roll, ...	271	
		284

Honorary.

Number on roll Oct. 1, 1883. 6
Number on roll Oct. 1, 1884. 6

Deceased Members: M. H. Jones, Easton, Pa.; W. G. Cartwright, Hoboken, N. J.

C. J. R. Humphreys, *Sec. and Treas.*

Examined and found correct.

Jno. Andrew, G. S. Hookey. } *Financial Committee.*

On motion of Mr. Helme the above report was received and placed on file.

REPORT OF SPECIAL COMMITTEE.

Mr. J. R. Floyd—I have to report that the coachman who, at the time of our last meeting, held in the city of New York, while driving a coach containing members and guests of the Association, was thrown from his carriage and quite severely injured, was confined in the hospital for three months. While he was in the hospital I expended fifty dollars in his behalf, and after he was discharged from the institution, I gave him fifty dollars to start him in the world again. This is all I have expended of the sum of three hundred dollars which was appropriated by the Association for his benefit.

On motion of Mr. Harbison, the report was accepted, and the thanks of the Association were tendered to Mr. Floyd for his services.

COMMITTEE ON PRESIDENT'S ADDRESS.

Capt. W. H. White—There are very many suggestions contained in the address of our President which are worthy of very attentive consideration and action, and I move that the Chair appoint a committee of three to take into consideration the recommendations contained in that address, and report thereupon to the Association.

Mr. S. G. Stiness—I very heartily concur in the suggestion of Capt. White, and second his motion.

The motion was agreed to, and the President subsequently appointed the following members as such committee :

F. C. Sherman, New Haven, Conn. ; W. H. Denniston, Pittsburgh, Pa.; and D. D. Flemming, Jersey City, N. J.

The President—There is another special committee, but I understand that they are not now ready to report on account of the absence of some of the committee. That is the committee to which was referred the two previous addresses of the Past-Presidents. If there is no objection, that matter will stand over until the committee are ready to report.

This brings our regular business up to the point of the election of officers for the ensuing year. What action will you take in respect thereto?

COMMITTEE ON NOMINATIONS.

CAPT. W. H. WHITE—I move that a committee of five be appointed by the Chair, to report to this Association nominations for officers for the ensuing year.

MR. S. G. STINESS—I second the motion.

The motion was agreed to, and the President appointed the following committee: Messrs. D. D. Flemming, Jersey City, N. J.; C. H. Nettleton, Derby, Conn.; T. Littlehales, Hamilton, Ontario; G. S. Hookey, Augusta, Ga.; and Marcus Smith, Wilkesbarre, Pa.

MR. W. HELME—I desire to ask information upon a point that I am not very clear about. I know that it was discussed once before, but I have forgotten what the result was. Are the nominations which this committee make to be considered binding and final, or are they not?

CAPT. W. H. WHITE—Certainly not.

THE PRESIDENT—The action of the committee must be endorsed by the Association before it becomes final. The Association can, of course, take such action upon the report of the committee as it deems best. The Committee on Nominations is appointed merely for the purpose of despatching business. I think that the report of the Nominating Committee has generally received the indorsement of the Association without any question.

Such indorsement has been so usual that perhaps it has come to be looked upon as a foregone conclusion; but I do not think it is well for the Association to consider that such is the fact. The report of the committee may sometime create dissatisfaction in the ranks. While members of the Association might, as a general thing, be perfectly willing to indorse the action of the committee, yet they do not always feel at liberty to express their views upon it. I think that each member should feel that he has perfect freedom to dissent from the action of the committee if it does not meet his approval.

MR. G. A. HYDE—Would it not be well for this committee to be instructed to recommend more than one person for each

of the offices to be filled? It might be that those named by the committee would not exactly suit the Association; and if two members were nominated for each office, then we might have an opportunity of selecting the one whom we preferred.

MR. J. P. HARBISON—I hope that that suggestion will not be adopted by the Association. It would, I think, serve no good end, and would cause an unnecessary consumption of time in the matter of election of officers. The Nominating Committee is composed of appointees from different sections of the country; and in their report they carefully consider questions of location, as well as qualification; this being the case, I think their action may be assumed as fairly representing the views of the Convention. If any member has any suggestion which he wishes to make to the Committee, and which he thinks should influence their action, such suggestion will be properly received, and will be given due consideration. I do not think it would be well to have the Committee report a duplicate set of names.

THE PRESIDENT—It has been the custom to authorize the Secretary to cast the unanimous ballot of the Association for the nominees of the Committee. Any member has the right to object to such action; and a single objection would invalidate such ballot. It is also in the power of any member to call for a ballot on any particular name, or upon all the names presented by the Committee. Of course such an objection would necessitate the election of each officer by ballot, and that would consume a great deal of time. We have usually exhibited our confidence in the fairness and wisdom of the Nominating Committee by accepting their recommendations without demurrer. Of course it may not be always well to do this; nor should we consider our action in the past as establishing a precedent so binding that we cannot depart from it. If any gentleman has a candidate whom he prefers to any one named by the Committee, he has a perfect right to object to the unanimous ratification of the action of the Committee, and to cast his ballot for his choice. If there is any dissatisfaction with the nominations made by the Committee, it is entirely

proper for any member to call for a ballot on any particular nomination, or on all of them.

MR. W. PARRISH—I do not understand that there is any obligation resting upon any member to vote for the nominees of the Committee.

THE PRESIDENT—None at all.

COMMITTEE ON PLACE OF MEETING.

MR. J. P. HARBISON—I move that a Committee of five be appointed by the Chair to select and recommend to the Convention a place for holding the next annual meeting.

The motion was agreed to, and the President named the following as such Committee:

John Balmore, New York city; J. M. Starr, Richmond, Ind.; J. P. Harbison, Hartford, Conn.; Thomas Turner, Charleston S. C.; John H. McElroy, Pittsburgh, Pa.

MR. G. A. HYDE—I think that Mr. McIlhenny has a letter which will be of interest to the Committee, and possibly shape the action to be taken

MR. G. A. MCILHENNY—I have a letter from General Hickenlooper, inviting the Association to meet at Cincinnati, Ohio, next year. He has an entirely new works in successful operation, and he suggests that it would pay the members to come to Cincinnati, Ohio, if for no other purpose than to see his new plant.

MR. J. P. HARBISON—Is it understood that this Committee will report the first thing after recess?

THE PRESIDENT—Such is the time that the report will be called for. It there is no further business before the Association we will proceed to the reading of papers. The first is presented by Mr. S. G. Stiness, of Pawtucket, R. I., on the subject of

VALVES *VS.* CENTERSEALS.

MR. STINESS then read as follows:

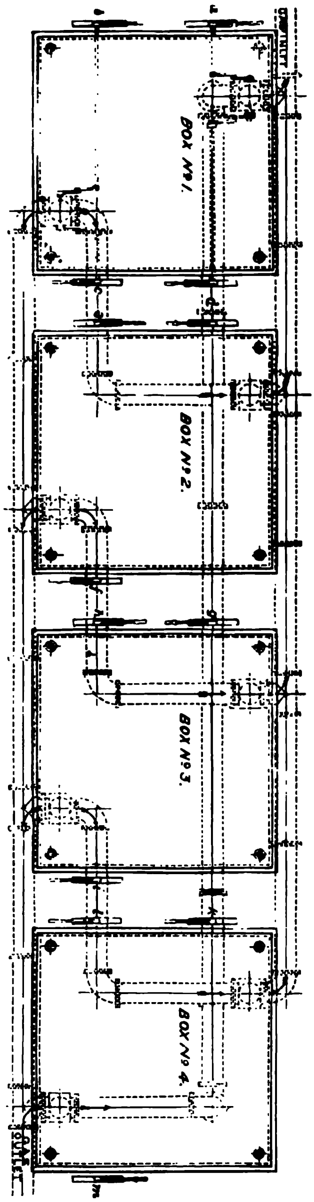
Gentlemen of the Association:—*Via trita, via truta*, is an old adage, and, in the business in which we are engaged, one well

worthy of being remembered. While the "beaten path" may be the path of safety, it may have been traveled so long, and the ruts worn so deep, and the undergrowth so thick, that we fail to observe the open fields where the pathway is level, the journey easy, and we be permitted to enjoy alike the freedom of safety and the pleasure of wandering at our own sweet will.

And it is with feelings of kindly sympathy that I enter upon the discussion of the subject of "Valves *vs.* Centerseals" for working of purifiers, since the old-time centerseal system has been, and is still even now considered by many, as an old friend—long tried and true. In looking over the history of our business we find that, for many and many a year, the centerseal has been the beaten path which we all have traveled; and while I would speak kindly of the "bridges over which we have in safety passed," I feel that the centerseal, like many other things which were good in their day, has outlived its usefulness, and new devices more in accord with the demands of the hour will be adopted for the easy, convenient, and positive working of purifiers.

Some two years ago, being obliged to erect an entirely new plant in the works of our Company at Pawtucket, R. I., and desiring to place the purifiers in line, I became fully impressed with the idea that some system could be devised to relieve one of the annoyances occasioned by a leaky centerseal. I believed, after careful examination, that some plan could be devised whereby I would secure a system efficient in its operation, besides being inexpensive in its construction; and, further, be an arrangement by the use of which one or more purifiers could be worked in connection with others—in short, an apparatus that would allow one to work with almost any change desired. Of course, it is well known that such a practice could not be followed while working with the common centerseal.

After considerable study and examination of the matter I determined to adopt the plan or arrangement of valves and pipes as furnished by the Smith & Sayre Manufacturing Company, of New York city. This arrangement consists of a series of pipes passing under the purifiers, and valves in boxes directly


BOX Nº 1.
BOX Nº 2.
BOX Nº 3.
BOX Nº 4.

under the inlet and outlet pipes of purifiers, as per diagram which I herewith submit, and will now proceed to give a brief description of their location and operation.

The first is the inlet box to first purifier; it is a double valve box fitted with one valve (a slide or clapper valve) from retort house side, the other being an extra valve, the function of which is to close communication with the inlet from No. 4 purifier to No. 1, when used in that combination, and is intended only to be a stop for the long pipe. All other inlet boxes are single, are all in line, and connected with one pipe. All outlet boxes to station meter are double, are all connected with one pipe, and also are all in line.

With the inlet from No. 1 to retort house open, and inlet from No. 4 to No. 1 closed, the gas passes up through and to the outlet box of No. 1. When the outlet valves are closed and the inlet to No. 2 is open, and inlet from main of No. 2 is closed, the gas passes up through No. 2 to outlet of No. 2, which is in the same combination as outlet of No. 1, then to inlet of No. 3; and when inlet of No. 3 to No. 4 is closed it passes up through No. 3 to outlet. When the outlet of No. 3 to meter is open and inlet to No. 4 is closed, gas is then passing through three purifiers, and direct on to station meter. If change is made on No. 3 (when fouled), the outlet to meter of No. 4 is opened, inlet from No. 3 to No. 4 is opened, and outlet from No. 3 is closed—gas is then passing through all four purifiers.

When No. 1 is to be cleaned, the inlet from retort house to No. 2 is opened, and inlet from retort house to No. 1 is closed, the inlet from No. 1 to No. 2 is closed, and No. 1 is thrown out of use, ready for cleansing and refilling. When No. 2 is to be refilled, the inlet from No. 4 to No. 1 is opened, outlet to meter of No. 1 is opened, outlet of No. 4 is closed, as also is inlet from No. 2 to No. 3, and No. 2 is out of action—the gas passing back from No. 4 to No. 1.

Only three valves are required to be opened at any change, and only three valves are necessary to shut off any purifier; and thus with ease and facility are the different operations completed. Any desired number of purifiers may be placed in

line, the only necessary additions being valves, and pipe connections. By making a few cross connections, any wished-for combination could be effected.

The valves being made to act with a sliding motion, as they strike the side of the box they scrape off all the tar or sediment which may adhere to it, allowing the valve-joint to be made perfectly tight, with the consequence that no crude or unpurified gas can pass when making a change, as often happens to be the case when working with a common centerseal. The valves are placed overhead, and this disposition gives a perfectly clear space of cellar floor. They are worked by levers from floor of purifying house. All valves when open point east, when closed they point west. Marks with grips are lined on floor to show proper position and to hold levers in place.

After an experience extending over a year I am compelled to say that I could not be again tempted back into the old beaten path, as I am fully convinced that the plan above described, or some other system alike in character, will speedily be generally adopted for the working of purifiers ; and this conviction is forced upon me from the knowledge that amongst the benefits to be gained in the new departure are ease of action, certainty of operation, and the impossibility of leakage. Should you agree with me in this, may I not safely claim that the new system readily proves itself far superior to the old and long-tried, but, nevertheless, inefficient centerseal ?

Mr. Stiness added that the diagrams he submitted would better explain the working of the system he had in use than any possible verbal explanation he could make. He asked the members to inspect the diagrams carefully.

Mr. M. N. Diall moved that a vote of thanks be given to Mr. Stiness for his very interesting paper.

The motion was unanimously adopted ; and President Stedman announced that Mr. Stiness held himself in readiness to answer any questions that might be asked with reference to the subject treated of in the paper.

Mr. W. Helme—When a gentleman so well known to the profession as is Mr. Stiness abandons our old friend the cen-

terseal, he must have had some good reason for such action. The centerseal, as made nowadays, requires the exercise of considerable care in its construction, both as to casting and grinding—indeed, the casting is an exceedingly difficult one to accomplish. One great bother is the shrinkage which sometimes takes place, usually happening in parts of the casting that are most difficult of access. If the shrinkage difficulty could always be overcome to a certainty, then, with the aid of the improved machinery in use in our foundries, we ought to be enabled to make perfectly tight-jointed centerseals. It is essential, for the securing of a tight joint, that there should be no fault with the casting. I can say that I have put in centerseals (after examining the joints, and considering myself perfectly competent to say when a job of that kind was successful or not) which I thought were thoroughly tight; but I have found, after some months of working (in one case after some years), that leaks were taking place; and these bothered me not a little to remedy. In making search after the defect I found a considerable space where the strength of the iron was not sufficient to overcome the shrinkage strain that existed, and the parts had cracked.

We all know one great advantage of the centerseal is that a careless man cannot fail to turn it to the proper point. I am always apprehensive that the workmen in attendance upon valves, when either opening one or shutting off another, may fail to make a proper circuit. This is the principal objection I have to urge against the use of valves on purifiers. The original centerseal was a very different instrument to the one now employed. I am inclined to the belief that the old wet centerseal, provided it did not wear out or rust out so soon, would be quite effective and answer the purpose very well, and I have often thought it possible that it might be made out of some sort of metal which would ensure its lasting for a very long time. Having gotten through with the wet centerseal, we came back to valves—which were in use before centerseals were ever heard of. This matter is one upon which we may have a very honest difference of opinion. Mr. McIlhenny has, I think, had a set of valves in use for some years. Some ten

or twelve years ago it was said that one of the best gas works builders in Europe had discarded centerseals; and when on a visit to the other side some time ago I noticed that, at one of the prettiest gas works it has ever been my pleasure to inspect (at Belfast, Ireland), valves were used. Still, it was said they considered their use was attended with risk. If a careless workman neglected, no matter from what cause, to open a certain valve, why there was trouble. I am inclined to consider the centerseal a pretty reliable stand-by. If well and properly cast, I do not see why it cannot be made just as reliable as the valve. There is, however, this objection to the centerseal, namely, it necessitates keeping twenty-five per cent. of the purifiers idle, but this evil may be overcome by the duplex centerseal. It is a complicated affair, but so arranged that any box can be shut off and brought into action at pleasure. By the use of the duplex centerseal in place of the common style, the purifying surface is increased by thirty-three per cent.

Mr. J. R. SMEDBERG—In 1856 or 1857 I had some correspondence with our lamented friend, Mr. Jos. A. Sabbaton, in regard to the then recent introduction of the dry center valve. His view was that if the dry center valve had been devised first, and the wet valve afterward, this last would have been considered a great improvement, as affording a positive hydraulic closure at each line of division. About this, however, he perhaps went too far. The engaging surface of box and cover in the dry valve may leave the shop absolutely true, and yet be shaken out of "true" in transit, or by caulking in erection where socket joints are used; but the travel of cover on box is so slight that there is no objection to grinding down *with emery* after the valve is in place and connected, and this must secure a tight joint. I have built a great deal of rotary valve work, and find the leakage to be purely insignificant. To accomplish all possible permutations of flow, the Chartered Company adopted a group of six four-way rotary valves at their Beckton station. Mr. William Farmer accomplishes, in effect, the same result by a duplex cover to the ordinary dry valve. But until we pay more attention than at present to the

bisulphide of carbon, the present dry valve, with its sequence of lime boxes in one uniform direction, is all that can be desired. I say this only in defense of the dry center valve, and not as criticising the mechanical ingenuity of the system which Mr. Stiness advocates.

Mr. Stiness—I wish to state my position distinctly, in order that there may be no misunderstanding. In my paper I have taken pains to italicise the words "common centerseal." In regard to the duplex centerseal of Mr. Farmer, while I acknowledge it has good qualities, its expensiveness is so great as, in small works, to make its use almost prohibitive. In my paper I leave entirely out of consideration any reference to the duplex centerseal. It was not mentioned in the subject as proposed by me. My friend Helme has spoken of the liability (when working with a system of valves) of a valve not being opened when another was closed. While I admit there is a possibility that this might occur, I might go further and say that there might be a possibility of somebody closing the inlet of the holder. You might open two with the same lever. The possibilities of closing the wrong valves under the plan in use at my works are very small indeed. The small cost of this arrangement when compared with that of the centerseal, will of course bring it into use in many small plants. Now, there is another advantage attending the use of these valves over that of the common centerseal. A few weeks ago I drove to my works on a Sunday afternoon, and while sitting in the office my foreman came in and showed me a paper slightly stained. All the foreman was obliged to do to cure the trouble was to open two valves. The gas was then passing through four purifiers. Having a barge of coal in at the same time, and not having a sufficiency of men to attend to the purifiers, we concluded to let that box remain until the following Wednesday before it was cleaned. Now, you can at any moment change a fouled purifier to a state of cleanliness, or let it lay and change it at your convenience; you can do with it just as you please; you have all the advantage of a centerseal. I make that distinction, and it seems to me to be a distinction, in works of moderate capacity, well worth considering. That, of course,

cannot always be done in large works. I am free to admit there is the possibility of neglect; but still, in the works with which I am acquainted in various parts of New England and elsewhere, I hardly think that the question of neglect would come in as an important factor.

MR. T. LITTLEHALES—I have had eight years' experience with slide valves, and also twelve years' experience with centerseals; and I have no hesitation whatever in pronouncing very strongly in favor of the centerseal over the slide valve. I am aware of only two objections that can be urged against the centerseal. The first objection is that it keeps one box always idle; the second being that if its face is not perfectly true, a trifle of the impure gas will pass. Here are the only two objections which occur to me, or which I ever heard expressed, against the use of the centerseal. Now, the first objection practically obtains with whatever form of valve you use. The fourth box, after being changed, is generally allowed to stand for a while to sweeten, and therefor, as a general rule, the saving is unimportant so far as the fourth box is concerned. As to the next objection, you are liable to the very same difficulty whether using slide valves or centerseals. This trouble with the centerseal very largely arises, according to my experience, from the caking of the tar. If the gas is not properly condensed or is impertectly washed, you will get a slight deposit of tar on the face of the valve, and slight leaks may ensue. In twelve years I have been caught twice (and in the same way) by getting a little foul gas passed. By lifting up the cover, and taking a longer stop, the whole difficulty is removed. I have been caught in a much worse manner with slide valves arranged precisely as the gentleman has suggested—with three valves to each purifier. If the spring wears sufficiently so as to allow the face of the valve to go to its seat, you have precisely the same difficulty that you have with the centerseal. It is not every man in a gas works who can keep the run of twelve valves in his mind. The consequence is that he will some day make a mistake if something untoward or unforeseen takes place. So far as concerns the first named trouble, it may be remedied by an improvement in the valve construction; and with respect to

the second difficulty (the leakage), I am positive there is just as great liability for it to occur with the slide valve as with the other. If I were to abandon the centerseal I should substitute the six four-way valve arrangement. It seems to me to be the present aim and object of gas men to have such class of apparatus about their plant as will enable them to accomplish the greatest amount of work with the least outlay of motion. In my opinion the centerseal most nearly accomplishes this end. I think it would be decidedly in the nature of a retrograde movement for plants of a capacity admitting of the use of a centerseal to go back from the center valves to the slide valves. Of course we know that in every large works, when reaching the dimensions of 24-inch connections, size determines the whole question. Then it is no longer a question whether we would prefer a center to a slide valve, since it would be impracticable to make a valve of sufficient size to work well with such a large connection.

MR. E. VANDERPOOL—I think the objection to the system suggested by Mr. Stiness is the danger of stopping the gas. We have had a system of bye pass valves in use for nine years, on purifiers that are 25 by 30 feet, with 20-inch connections, and we only use two valves to each purifier, or seven valves for four boxes. The valves are four-way valves, opening with a quarter turn ; and it is impossible for them to cause a stoppage, or to interfere in any way with the passage of the gas. The gas either goes into the purifier, or else into the main pipe ; and in nine years we have never had a stoppage. I think we get better purification by using the valves, and extended experience shows that independent valves are more satisfactory than either the dry or wet centerseal. We think we get a better circulation of the gas through the box. By having the inlet pipe in one corner, and the outlet pipe in another corner, we get the gas traveling entirely across the box, which cannot be done with the ordinary centerseal. Moreover, this system enables more careful tests of the gas to be made at the outlet of the purifiers. We have found it to work very well indeed. We have never had any difficulties, and can use four boxes, or three, or two ; and in case of trouble we can shut one box or all of them off

without interfering with the passage of the gas, or shutting down the works.

A MEMBER—What would be the comparative cost between one plan and the other?

MR. VANDERPOOL—I think, with these purifiers 25 by 30 feet, there was a difference in cost of about $1,500 between putting up this arrangement and a centerseal.

A MEMBER—With the centerseal, would the cost be that much greater?

MR. VANDERPOOL—There is not so much pipe connected with the centerseal. This additional pipe makes the independent valve system about $1,500 more expensive than the centerseal.

MR. JAMES M. STARR—I would like to ask Mr. Stiness, with regard to his visit to the works on that Sunday, how it was he could, by merely changing his valves, have purified gas until the following Wednesday; and also if he did not have one of his purifiers idle. If he had, then he was in no better fix than those who use a centerseal, and who always have one purifier idle. Again, as to the advantage of being able to work four purifiers—would you not have the disadvantage (if you only had four purifiers and were working all of them, and your fourth purifier showed foul gas), that you could not change it until you could fill the first purifier again? You would have to throw off the first purifier and use it only with three, until you could refill the first one. This would give a great deal of trouble in cases where boxes have to be filled every other day, or every three or four days, and would increase the length of time when one would have to keep passing the fouled gas. With a centerseal, where you can always have the fourth purifier off, would it not be better to be compelled to that course than to be thrown into the other dilemma of being obliged to pass on the fouled gas until the change could be made?

MR. STINESS—I suppose Mr. Starr knows when one purifier is thrown off atmospheric air enters it; it immediately becomes heated, and it is then much more offensive to clean than is the case when the cover is raised and the spent material imme-

diately removed. That gives an advantage. Of course, in the case of a purifier which has lain over from Sunday afternoon until Monday morning, and atmospheric air mixing with the material to a limited extent, the lime would become heated. In the other case, we wait and take our pleasure.

MR. STARR—We do the same thing, but atmospheric air is not allowed to come into the boxes. We sometimes allow the sponge to remain in the box for three or four days before emptying; but we see to it that no atmospheric air enters.

MR. JOS. R. THOMAS—In an examination into the question of the employment of valves instead of a centerseal for working purifiers I have concluded that the system employed by Mr. Vanderpool, at the works of the Newark (N. J.) Gas Light Company, was one of the oldest plans of the kind in use in this section of the country, and I also think it one of the best valve systems that has been devised for the purpose. Not only is it the oldest plan of the kind in this country, but it has proven itself efficacious in method and always reliable in its working. With his system a stoppage would be out of the question, since the gas can always find a free passage. It has been in use for a sufficiently lengthy period to fully and completely test its efficiency, and the best proof of efficiency is contained in the statement that it has always worked satisfactorily. In my frequent visits to the Newark works I have never found anything to contradict this assertion. As far as my experience teaches me, I have never had any trouble with regard to satisfactory working of the wet centerseal. The drum, of course, will wear or rust out in time; but this can be easily provided for by keeping a duplicate drum on hand. The chief advantage claimed for the valve system is that all four of the purifiers can be kept in use. This can also be done with the Farmer drum; but I really doubt very much if anything important can be gained in such a way. I have known of instances where the gas fouled quicker when using the dirty box than it did when working only through the three purifiers. The system advocated by Mr. Stiness certainly is not new, nor is it an improvement on what we have had before in the method

of employing valves instead of centerseals. Indeed, to my mind it appears to be but a re-invention of something that had been "invented before."

MR. M. S. GREENOUGH—In discussing a matter of this kind I think that every fact bearing upon it, in the experience of any member, ought to be brought out. In the Boston (Mass.) gas works the purifiers have been managed in such a way that the gas could pass from one to another; and every purifier has been controlled by two valves—sometimes we use two and sometimes three at a time. But in the new plant which we have just completed we were very glad indeed to get rid of the valve system, and have put up a 24-inch dry centerseal. It is possible that I may come here before you next year or the year after and say I am very sorry that we did not have this thing before; and I may be very sorry that we did not adopt the plan of Mr. Stiness; but at present I must say that we shall be very glad to dispense with the valves.

Mr. A. E. BOARDMAN—I have recently had some experience both with centerseals and with valves. I use them both in my works. On one occasion, when changing a purifier which worked with a slide valve, I thought I had opened it; but when I shut down the valve on the other purifier I began to blow my seal. On investigation I found the spring had slid over the valve and had not left the gate. That is an accident which is liable to occur wherever you have slide valves. As I understand it now, the discussion is on the slide valve arrangement for purifiers, rather than the four-way valve. I think that the liability to shut off gas under the slide valve arrangement is very great, especially so with inexperienced men, such as you are obliged to employ around small works. Very frequently neither myself nor my foreman can be at the works when it is necessary to change the purifiers, and a common laborer cannot change them with the slide valve. In my experience, I would not allow my laborers to touch the slide valve which controls the lime purifiers. I think the chance of leakage through the centerseal is no greater than the chance of leakage through the slide valve. If both are well made they

will keep the gas back ; if either one of them be in any manner defective, the leakage result is the same. My experience is wholly in favor of the centerseal, and especially so for small works.

The PRESIDENT—Has Mr. Greenough the duplex valve in his new works ?

Mr. GREENOUGH—No ; we have only put in the ordinary valve.

Mr. E. McMILLIN—It has been asserted by several speakers that there is no more liability to leakage of gas with the centerseal than with the slide valve. I think that is a very great mistake. I have control of six works of moderate size, and in three of them is used the dry center valve, two being equipped with the ordinary slide valve, and the sixth being fitted with a wet centerseal. Now the last situation is really the only one in which I really have any trouble. On the 1st of last October (1883), a system of purifiers was fitted up with a 16-inch centerseal, and the workmen who placed them in position apparently did a good job ; still we had four men working at scraping and grinding for more than six weeks before we could use that centerseal. Mr. Helme says that if you can get a good casting you may grind it down so tight that it will not leak ; but I have not found it to be the case.

Mr. STINESS—You are right about that.

Mr. McMILLIN—If you are using lime, or a very small centerseal, perhaps it is. Our boxes are 20 by 24, and we fill them with oxide of iron. If we are crowded, and turn on the gas to third box, then within an hour from that time we will find the temperature of the gas from fifteen to twenty degrees higher when leaving than it was when entering. Now, if the gas is passing through a slide-valve, that valve is heated all over alike, and the whole pipe is heated correspondingly ; but with a centerseal just that part of it which the gas from the last box goes through heats up, and it will expand so that you can stick a paper right into the joint. We have that trouble even to this day, notwithstanding all our careful grinding. All last winter we had to melt a bar of sealing-wax around the joints

every time we changed; yet it was perfectly tight until we turned on the third box. Even by making the most perfect casting, and grinding down as carefully as possible, we did not succeed in preventing this leakage, which frequently was quite profuse.

MR. STINESS—I wish to say with regard to the system of valves I have had in use now for over a year, that while I do not claim the plan as the most perfect one in vogue, I do claim that it is very simple and very inexpensive. When you have a common centerseal and anything occurs (such as most of us have had some experience with), the centerseal will be tight until the changes—that is, there will be an incrustation of thick, tarry matter, or a deposit of lime formed on the face of the valve. Now, if anything occurs to valve-boxes such as I have in use, the works need not stop for one moment; you simply throw that valve-box purifier out of use, and then your work goes right on. It does not require the stopping of the works at all to fix any valve nor any valve-box in the system which we have. My friend spoke of twelve valves. There are twelve valves in that system.

MR. HELME—But only three in use.

MR. STINESS—In any change there are but three in use—two are open and one is closed; therefore the liability which my friend Littlehales spoke of is reduced to so small a point that I feel it need not be taken into consideration. What I do claim for the system is this; for ease of action, the certainty that no foul gas can pass, and that there can be no leak, it is preferable. In my case for the past two years we have used pounds of hard soap in order to keep the gas in the centerseal, and not let it go into the cellar of the purifying house. With me as with many of my friends from New England who have visited the Pawtucket works, it has not been found objectionable to have a slight lunch in the cellar of the purifying house, it is so perfectly clean. And then again (and this, I think, is one of the very best features), if anything does occur to a box, we have simply to throw that purifier out of use, using only one, two and three while repairing the valve-box. This I was com-

pelled to do at one time for a reason which I will now state, for, as my friend Greenough says, we ought to get out all these things, and our President says, we should tell everything and hold nothing back. When the valves were first made by the Smith & Sayre Manufacturing Company, after using them for a short time, I found it hard work to move one of them. I immediately threw that purifier out of position, took the box from its place and examined it. We have in the village of Pawtucket a firm (which, is, I suppose, known throughout the United States) entitled the Jenks Manufacturing Company, large producers of cotton machinery. I took the valve-box to their shop, and they told me that the work on the bearing, where the rocking shaft as it goes over and is thrown down and held by the cam motion (not by a spring) in its position, was as fine a piece of work as they had evcr done on any cotton spinning machinery, and this fineness was the cause of the shaft turning hard. I then immediately had the shaft turned upon the face side, and had a lubricating cup put in directly from the outside into the bearing; from that time forward it has worked in the most perfect manner. I feel that this statement is due to the system. Some people might ask me if they had ever given me any trouble. I must answer that they have, but that trouble was not inherent with the system, but owing to the perfectly accurate manner of the face fitting.

MR. HELME—There is no system which has no disadvantages. The statement made by Mr. Stiness to the effect that in his cellar there is no smell, is no positive evidence that his valves were not leaking, since a trifling leak might exist without being particularly noticeable. If a centerseal leaks the gas goes right out into the open air, and you notice it at once. While I have no objection to the valve I still think that the wet centerseal is better; but the trouble with that is this: No matter how good a metal is used, it will rust out after a while, and may some day rust out just when the defect would be most inopportune. It is necessary that a gas company should take the precaution of having duplicate parts on hand. Still, after all is said and done, if you have a cellar deep enough to admit of sinking a centerseal under the floor, so as to get your trap-door open, you will have

the best plan that anybody could desire, the least objectionable, and, I think, the least expensive. I think it would be less expensive even if you should make the valve out of white metal, which would neither oxidize nor wear out. When I spoke of the difficulty of getting a good casting I did not mean good iron alone, or a casting free from sand-holes and defects of one kind or another, but I mean a casting made to the proper proportion and thickness, so that when it cools off the shrinkage strain will be reduced to a minimum. The difficulty with the center-valves is that their interiors are made too light. The thinner the iron the sooner it cools off, and the inside will cool off more rapidly than the outer shell ; the result being that the shrinkage causes a strain on it. Now, if they would make this part heavier, so that it would be more likely to be sound, of course always using the proper sort of iron, I think there would be no difficulty. In addition I would make the top of the centerseal in two parts. The shrinkage is in the crown. It is all a question of shrinkage, and that is a question which bothers all machinists, for they do not seem to know how to get rid of it. If I were making a centerseal I would make the top in two parts ; in other words, I would cast the disk in one casting, and then have a lobe which I would grind on.

MR. FAY--One of the arguments used against centerseals is their liability to let gas leak into the house cellar; but I think if you will only caulk with cement the joint where the pipes enter into the centerseal you will not be troubled with any leak in that way. I use Portland cement entirely for making that joint, and I have no trouble with such leaks. I do not know of their occurrence where the practice outlined is followed. At the Denver (Col.) works we have a 16-inch centerseal in use, on boxes 20x30, and have no trouble at all with leakage. Mr. Stiness advanced the only valid argument, as it appears to me, in favor of valves when he said that by their aid you can go along under certain circumstances without stopping the entire works. Of course, if your centerseal gets out of order your works must be shut down. I can relate some of my experience in that connection. I have a 10-inch centerseal which had been in use for over four years. One of the divisions cracked

so badly that a knife-blade could be drawn clear down through it, and we had to stop the works in order to effect the needed repairs. The fracture occurred in the night, and it was only when the workmen noticed how rapidly the holder was sinking that we were made aware that an accident had happened. The process of distillation was at once stopped, and the seat of trouble speedily located. We got the box open and closed the crack with very fine rust; and that centerseal is as tight as any valve or centerseal that there is in the United States to-day. It has now been in use in that condition for six or seven months; it took about five minutes to do the job.

Mr. Neal—It seems to me there has been nearly time enough occupied with this discussion, but before it is closed I wish to say a word for this much-abused dry centerseal. I put one into my works about fifteen years ago, and it was the first one ever set up in New England. It was made by a Philadelphia firm. I have used it ever since both working with lime and iron sponge in the purifiers, and never have had a leak of any kind whatever. I prefer the dry centerseal.

Mr. Geggie—I suppose I have one of the best centerseals in use anywhere, but as it leaked we had to take it down and recaulk it. We intend to abandon the centerseals altogether, and adopt the system which Mr. Stiness has described.

Mr. Harbison—I would like to inquire of Mr. Stiness as to the preventatives against closing the wrong valves; whether he has in his cellar any system of indicators to show, by the position of the levers, which valves are open, and which are closed?

Mr. Stiness—It can be determined above the cellar, and in the purifying-house. I suppose my friend Harbison remembers that my purifying-house is on a level with the ground, and that my purifiers are on the second story. There are no indicators in the cellar where the valves are placed, because the valves cannot be worked from there. The indicator which might perhaps be relied upon the most is the position of the arm. Upon the floor where the grip is there is a plate marked "open," and "shut," and in whichever position the grip is that indicates

the position of the valve in the box ; that is, if the lever is in the "open" grip, we know that the valve is open. We have got so perfectly accustomed to them during the year in which we have worked them that we have never had the least trouble, nor am I ever obliged to be there during the opening or closing of the valves.

In this connection perhaps I may say that I have, in this new system of purifying (which need not be described, as it is shown upon the plan), a means of raising the cover by a hydraulic lift, so that I have the whole floor of the purifying-house entirely clear and free from the cumbersome means of lifting generally employed. Some of the purifiers are 20x24—those are the largest—and some are 12x16, and are ample for my present consumption. They are placed in such position that the lids can be raised by the hydraulic lift. It requires but one man to raise a cover, and it also requires but one man, under any circumstances, to open and close the valve. When the cover is closed overhead we require two men, owing to the fact of its weight being so heavy one man cannot pull it on the tramway. I think that the system of raising covers by means of a hydraulic lift is worthy the attention of the Association. We move the cover directly overhead and forward on to the other purifier.

Mr. Helme—I think that Mr. Stiness has made out a very good case in favor of the system ; but I would like to know what Mr. McIlhenny's views are after an experience of ten or twelve years with valves and centerseals. He has had a large set of purifiers running for that length of time, and has used both systems.

Mr. McIlhenny—We have had a set of purifiers fitted with what is called the Anderson four-way valve, and it has been running for eight years. I have had no trouble whatever with it. One man can change the purifier at any time, and a couple of men can raise the cover. It requires a quarter turn to change the gas from one direction to another. We can never shut the gas off ; we may change the current, but can never close it out altogether with these valves. There are six valves to work four purifiers. We have those valves all over our works—in the

scrubber-room, and also in the engine-room. They are four-way valves. I prefer the valves to the centerseal. They admit of much easier adjustment and change, and give much less trouble. Further than this, in every respect, they have not cost us anything for repairs since we put them in. We can also, as Mr. Stiness mentions, eat dinner in our purifying-house.

MR. HELME—What size are the connections?

MR. MCILHENNY—Twenty-inch.

MR. HELME—Mr. McIlhenny's evidence is pretty good testimony in their favor.

A recess was then taken until 2 o'clock, P. M.

FIRST DAY—AFTERNOON SESSION.

The Association reconvened promptly at the appointed time.

The President stated that the first business in order would be the presentation and reading of a paper by Mr. C. E. Hequembourg, of Bradford, Pa., on the subject of

NATURAL GAS.

Mr. Hequembourg then read as follows:

Natural gas attracted attention as an agent for illumination as long ago as 1821, when a gas spring or well was discovered at Fredonia N. Y., within a rod of the old State road that passes through the village. The spring as then is now located in the slate rock that forms the bank of the Canadaway Creek. Gas was collected by excavating and covering the spring, conveyed into a small copper holder, and from thence conducted through pipe to a mill and several stores for illumination. To Mr. Elias Forbes, of Fredonia, I have been for many years indebted concerning information given regarding this gas; and he now vouches for the accuracy of the following statement obtained from a history of Chautauqua County:

"The use of natural gas at Fredonia was begun in 1821, when experiments were made to determine its illuminating value, and it was introduced into a few of the public places, among which was the hotel that then occupied the site of the Taylor House, and which was thus illuminated when Lafayette passed through the village in 1824. The gas so used at that time was the first used in the United States, and the gas works established here were the first in this country. The spring first discovered, and from which gas was first used, is located on the north bank of the Canadaway Creek, at the bridge crossing the stream on Main street, in the village of Fredonia. The gas escaped in various places in the immediate vicinity; but when the well was sunk it was all drawn to it. The gas from this well, which was sufficient for thirty burners, was used alone till 1858 when another was sunk on the creek in the northwest part of the village, by Preston Barmore, the shaft being thirty feet deep, six feet in diameter at the top, and fourteen feet at the bottom, with two vertical borings, one of 100, and the other of 150 feet depth. In the Fall of 1858 Elias Forbes, the present president of the gas company, purchased a half interest in the well, and that Fall a company was formed, and during the remainder of that and the following year the gas, in sufficient quantity to supply about 2,000 cubic feet per day, was conducted to the village through three miles of mains, and supplied directly from the well to the stores of the village. During the latter year (1859) the company put in a gas receiver or holder of 12,000 cubic feet capacity, and supplied private houses. In the Fall of 1871 Alvah Colburn made a boring for gas near his mill, with a view to supplying fuel for generating steam therefor; but the supply was inadequate for that purpose, though it was evolved in considerable quantity. He therefore purchased the Barmore interest in the gas company, and connected his well, which is 1,200 feet deep, with the company's receiver; since which time the supply of gas has been ample for the demands of the village. Previous to the opening of Colburn's well the supply of gas was not sufficient to meet the demands for it during the winter, and the deficiency was made up by gas manufactured from coal.

Prof. Hadley's experiments show that the consumption of natural gas as compared with that manufactured from coal, through burners of equàl capacity, and in equal times, is less than one half, with a greater candle power. He shows that a burner which consumed six feet of coal gas in one hour, with an illuminating power equal to fourteen sperm candles, six to the pound, consumed of the natural gas a fraction less than three feet, with an illuminating power of a little more than sixteen sperm candles. The natural gas also possesses a greater diffusive power, and one who has been accustomed to the use of coal gas, finding it difficult to read ordinary print without being in close proximity to the light, is astonished at the facility with which he can read in any part of an ordinary-sized dwelling room under the light from the natural gas."

For an analysis of this gas, and that of other gases, especially that obtained from the Wilcox well, in Sergeant Township, McKean County, Pa., from which, and others near by, the city of Bradford obtains its present supply, I copy from the paper of Prof. Samuel P. Sadtler, read before the American Philosophical Society, March 2d, 1877: "During the past summer (1876) I was again employed in the service of the Second Geological Survey of the State, and spent a month in the oil regions of Pennsylvania. While on this trip I collected six new lots of natural gases, and have recently completed my examination of them. * * * *

"Result of analysis of the gas obtained from the Wilcox well, in August, 1876:

Carbonic acid	.02
Carbonous oxide	.15
Ethylene series	.62
Hydrogen	7.55
Marsh gas	62.37
Ethyl-hydride	29.29
Propyl hydride	trace.
Oxygen	——
Nitrogen	——
	100.00

* * * * * * *

The analysis of gases obtained from the Lake Erie border in Pennsylvania and New York are also found in this paper; No. 1. being of Erie gas, from Erie, Pa.; No. 2, of older Fredonia well; No. 3, of newer Fredonia well, and collected in August, 1876, resulting as follows:

"No. 1—Carbonic acid		.30		
Carbonous oxide		.61		
Ethylene series		——		
Hydrogen		.43		
Marsh gas	40.33	98.59	69.44	
Ethyl-hydride	58.26		trace.	
Propyl-hydride	trace.		29.15	
Oxygen		.07		
Nitrogen		——		
		100.00		
"No. 2—Carbonic acid		.44		
Carbonous oxide		.84		
Ethylene series		.42		
Hydrogen		8.56		
Marsh gas	40.83	89.73	65.28	
Ethyl-hyride	48.90		trace.	
Propyl-hydride	trace.		24.45	
Oxygen		——		
Nitrogen		——		
		99.99		
"No. 3—Carbonic acid		.28		
Carbonous oxide		.22		
Ethylene series		.47		
Hydrogen		7.49		
Marsh gas	26.99	91.55	59.27	
Ethyl-hydride	64.56		trace.	
Propyl-hydride	trace.		32.28	
Oxygen		——		
Nitrogen		——		
		100.01		

"The hydrocarbons of the marsh gas series in these three analyses can be counted together with perfect accuracy, as 98 59-100; 89 73-100; and 91 55-100 per cent. respectively; or we have a choice of two methods of reckoning the individual amounts, with proximate accuracy, however, only. In these analyses the second method of estimation, viz.: that of dividing the amount between marsh gas and propyl-hydride, appears the more probable. A casual examination of these figures, with reference to the approximate geological horizon in each case, will show several well-marked peculiarities. * * * *

"The gas from the McKean County geological horizon obtained at the Wilcox well, is distinctly different from any of those preceding it. The 29.29 per cent. ethyl-hydride makes it a heavier gas. The three gases from the Lake Erie border however show the greatest differences. The per cent. of the ethyl-hydride exceeds the per cent. of Marsh gas, so that it becomes reasonable to estimate some of these heavy hydro-carbons as propyl-hydride. These three gases would be the heaviest of all those examined. An experimental determination of the specific gravity of the Erie gas, made by the diffusive method, gave 804; the specific gravity as calculated from the analysis was 845."

After gas was found at Fredonia such discoveries from year to year became more common. Judge Campbell, of Westfield, N. Y., by contract with the U. S. Government, lit (until abandoned about the year 1856) the lighthouse at Barcelona (a small harbor on Lake Erie) from a spring of natural gas.

In 1827 a contract was made by Walter Smith, of Dunkirk, N. Y., with the Government to light the lighthouse at that place for a term of years, and a ½-inch lead pipe was laid 2½ miles from the Matteson gas spring at Fredonia; but, owing to the size of the pipe, no flow was obtained, and after many trials of other means of transportation the enterprise was abandoned. With the discovery of oil at Titusville, Pa., in 1858–9, the many borings yielded more or less gas, and the first public notice taken of it in quantity was the burning of the Rouse well, in Oil Creek, where a large number of persons lost their lives by the explosion of gas, it having been fired from a lighted

cigar. As strange as it may seem, this gas was then considered more of a nuisance than an article of value, and but little was used as fuel—it was mostly led from the wells in pipes and burned so as to dispose of it. Anyone who passed through Petroleum Center in 1869, when the oil development of McCray Hill was in its prime, cannot fail to remember this great waste of valuable fuel.

With the improved methods of dry drilling, gas has been more easily found and controlled; and although natural gas in late years has been found outside of the oil regions, where there was even no indication of oil, such facts only tend to strengthen some of the theories advanced regarding its origin. The most reasonable is that gas is found in the sand rock or oil sand only, as is salt water; and that its presence there is owing to fracture of the rock below. All gas wells of great volume are supposed to be fissure wells—the gas being generated in the carbonaceous shale hundreds of feet below any of the oil-producing sands. That this is reasonable may be concluded from the fact that the largest wells do not at all times fill up the adjoining sand rock, but only the faults or extreme edges; and it is a known fact that in sand rock where there is the most oil the gas is lightest, and where there is little oil the gas is strongest.

As an illustration of the volume or pressure of gas, the wells used for the supply of the city of Bradford, located in Sergeant Township, Pa., are showing a pressure, confined, of 550 lbs. to the square inch; while that shown at ordinary oil wells, under like conditions, varies from the atmosphere to sixty pounds. The pressure at all times does not indicate the producing power of a well; but, as before suggested, the location of a well near to a fissure should make it lasting and profitable; or if too far remote, unsatisfactory and of small value.

A complete and valuable record and history of several of the wells now controlled and used in supplying the city of Bradford, can be found in report of Second Geological Survey of Pennsylvania, by Chas. A. Ashburner (pages 146 to 167, relating to Sergeant Township), published in 1880. The first of these wells

were drilled in 1864, and there is no section of territory yet developed that has produced a like quantity of gas.

For fuel in the manufacture of steel, iron and glass, the past two years' experience in the city of Pittsburgh, Pa., indicates that natural gas can take the place of other fuel to the advantage of the manufacturer; and, therefore, an elaborate comparison of cost between this gas and coal is not necessary, and would be made at great disadvantage, as there is no city in this country where coal is so cheap as at Pittsburgh. Were it not for the fact that gas fuel is so easy to control, clean, pure, and capable of raising the most intense heats, and that such considerations increase its value by the saving of labor and saving of the materials manufactured, it could not be used for these purposes, as will be shown hereafter by some limited tests as to its caloric power expressed in cubic feet, compared with a pound of coal, etc. For combined purposes of heat and light, "The Bradford Gas Light and Heating Company" supply an average daily demand of several millions cubic feet. This is done at an average cost to the consumer of thirteen cents per 1,000 cubic feet. The candle power of the gas supplied varies from 8 to 24, and the specific gravity, as shown by Prof. Sadtler, is about 804.

The gas registers in meters a little less than one-half that of coal gas, burned in the same time, through the same burner, with equal pressure. In order to supply the great demand for this gas the company own and control eight thousand acres of gas land, twenty-nine miles of eight-inch, seven miles of six, and several miles of 5⅝ inch, 3-inch and 2-inch cast and wrought iron high-pressure conduits, that carry gas from fields distant from Bradford two, twelve, and twenty-five miles. These mains carry variable pressure of 50 to 160 pounds to the square inch; and in order to increase the flow through these pipes during extreme weather they operate a pump station of 580-horse power to compress, and by additional pressure and volume, increase the flow. Results of many average tests show:

1st—Compared with coal gas, natural gas exceeds it in caloric value 33⅓ per cent.

2d—With crude, ordinary, and best methods for combustion, the caloric value of natural gas, compared with coal under best conditions, is—

With crude method - -	20	cubic feet=1	lb. coal.
" ordinary " - -	11.29	" " =1	"
" best " - -	7.92	" " =1	"

3d—The value of 1,000 cubic feet of natural gas, under conditions below, compared with coal at $1.00 per ton of 2,000 lbs :

With crude method of combustion	$0.0250	per 1,000 cubic ft.
" ordinary " "	- .0443	" "
" best " "	- .0635	" "

On motion of Mr. H. B. Leach, the thanks of the Association were tendered to Mr. Hequembourg for his valuable, interesting, and instructive paper.

DISCUSSION.

MR. M. S. GREENOUGH—I would like to ask Mr. Hequembourg if I understood him to say that the pressure under which the gas issued from the well varied from 50 to 60 pounds; and also if I understood him to state that the candle power varied from 8 to 24.

MR. C. E. HEQUEMBOURG—I stated that the confined gas from our well at Bradford maintained a pressure of 550 pounds to the square inch. The ordinary pressure of the gas from borings in the Bradford region (these borings having been put down principally for oil) varied from atmospheric pressure to 60 pounds to the square inch ; and usually, when confined, they seldom exceed 52½ pounds. I stated that the illuminating value of the natural gas used in Bradford varied, under different conditions, from 8 to 24 candles. The reason for this, as I understand it, is that there appears to be no method of burning natural gas satisfactorily except through the argand burner. With an argand burner rated to a consumption of five feet per hour, the photometric tests which have been made indicate 24 candle power; but under unfavorable conditions, or with burners

that are not adapted to consume the gas properly, the candle power is very limited.

MR. WM. HELME—Would the same gas, indicating 24 candle power when burned in an agand burner, run down to as low as 8 or 10 candle power when consumed in an ordinary fishtail burner.

MR. HEQUEMBOURG—It appears so.

MR. HELME—That is certainly a very strange feature. Does your figure of 550 pounds represent the original pressure at the time when the veins were first tapped?

MR. HEQUEMBOURG—No; originally the wells were opened twenty years ago, and we did not obtain control of them for purposes of supplying their product to the city of Bradford until about two years ago. During the first period of twenty years three of the wells were exposed, and no attempt had been made to control them. What the pressure was at the time they were first tapped cannot be stated; what their pressure now is can be readily told.

MR. HELME—Have the wells maintained a uniform pressure for the two years during which your company has controlled them, or is the pressure diminishing?

MR. HEQUEMBOURG—We do not see that it has in any way decreased.

MR. HELME—Is it at the same figure to-day that it was two years ago?

MR. HEQUEMBOURG—Apparently so.

MR. HELME—And the quality of the product remains similar?

MR. HEQUEMBOURG—Yes.

MR. PARRISH—You have had wells which gave a larger pressure?

MR. HEQUEMBOURG—I suppose that is possibly the case; but we never really had an opportunity to say positively what the pressure figure was until the wells mentioned in my paper were confined.

MR. GREENOUGH—Do these wells ever get on fire ?

MR. HEQUEMBOURG—Once in a while.

A MEMBER—At what depth do you usually strike the gas vein ?

MR. HEQUEMBOURG—Of course the depth at which the vein is tapped varies with the locality ; but it is usually pierced at about sea level through the country, which, in our vicinity, would be at a depth anywhere from 1,000 to 2,500 feet.

MR. J. P. HARBISON—It would be interesting to know what storage facilities the Bradford Company maintain, and whether the Company could supply a send out reaching to several million cubic feet per day.

MR. T. LITTLEHALES—At the times when you find the illuminating power so low, have you any method of supplementing it ?

MR. HEQUEMBOURG—I do not say that the candle power does vary ; I merely suggest that, owing to there being no proper method of burning the gas, none of the ordinary tests of illuminating value clearly indicate the candle power. In other words, a rated five feet coal gas batswing or fishtail burner will consume less than 2½ feet of this gas per hour. At the ordinary pressures in the burners mentioned you cannot burn a larger quantity than that just stated without showing a smoking or imperfect blue flame.

MR. T. LITTLEHALES—Do I understand your statement aright when I conclude your opinion to be that, as a rule, tested under the same conditions, there is very little change in the illuminating value ?

MR. HEQUEMBOURG—Yes, sir.

CAPT. W. H. WHITE—Do I understand that you use an ordinary argand or a Siemens burner in obtaining this high illuminating power ?

MR. HEQUEMBOURG—I use the ordinary argand burner. That is the description of burner which has been universally adopted as being the most satisfactory.

CAPT. WHITE—Have you made any tests with the Siemens burner?

MR. HEQUEMBOURG—We have a large number of Siemens burners in use, and, although we have not made any specific photometric tests as to the illuminating value of the natural gas product, compared with coal gas, when used in these burners, we believe the light exceeds that obtained from coal gas, on account of its higher calorific power.

MR. HELME—Do you purify the gas at all?

MR. HEQUEMBOURG—No; we do not find purification to be necessary.

MR. J. H. MCELROY—Did you make the statement that the evaporative effect of 22,000 feet of gas equaled that of one ton of coal; or that one foot of gas equaled one pound of coal.

MR. HEQUEMBOURG—Under the crude methods of burning natural gas as fuel (that is, burning it in its ordinary state in an open fire box), 20 cubic feet of the gas equals one pound of coal?

MR. MCELROY—I thought the figure was 22,000 feet. My experience goes to prove that 22,000 feet of the natural gas equals a net ton of coal. I thought you had substituted "pounds" for "ton." I have only heard of one description of natural gas that was reported to exceed an illuminating value of eight candles—that is, when burned under the same conditions. The exception is the natural gas from the Olean district, which has a power of twelve candles. The Olean gas is also whiter than the Bradford gas. I suppose you have seen the Olean gas?

MR. HEQUEMBOURG—Yes, sir. For five years we have supplied Bradford with a natural gas, and the source of the supply was within two miles of the field now drawn upon for Olean. It was practically the same gas, coming as it did from the same rock.

MR. MCELROY—The Olean gas has a perceptible odor of petroleum; indeed, all the natural gas that I have tested possesses that peculiarity.

Mr. Hequembourg—All McKean County natural gases have that feature.

Mr. McElroy—I have never carefully tested for illuminating value any of the natural gases excepting the Olean district product. I have, however, discovered that the Olean manufacturers place their computations on the basis that 22,000 feet of natural gas equals the calorific power of one ton of coal. It is sold to the blast furnace proprietors on that basis.

Mr. Hequembourg—We have made very careful tests of the calorific power of the Bradford gas—first, by measuring the number of cubic feet of gas that it required, under ordinary conditions, to evaporate a certain number of pounds of water. I took a boiler 14 feet in length, 62 inches in diameter, and having 96 three-inch flues. It was set in an ordinary arch. With this boiler I made a number of six-hour tests, using gas for fuel, under all sorts of conditions, and then reversed the firing conditions by substituting coal—care being taken to make the tests identical as to time, etc. We found that as a result we could evaporate about 8.55 pounds of water to the pound of coal. On the other hand we proved, taking the results ensuing from the best conditions of gas firing, that 7.92 cubic feet of the gas would evaporate 8.55 pounds of water.

Mr. McElroy—Mr. Young and myself also went through a series of experiments on this question. The natural gas tested came from the Butler County district. We tried all the various methods of evaporation. In our test-boilers we evaporated 9.5. pounds of water to the pound of Pittsburgh coal ; and the outcome of the tests went to show that the calorific effect of the ton of Pittsburgh coal equaled that resulting from a consumption of 22,000 feet of Butler gas. An approximate result was obtained in heating an iron puddling furnace. We weighed our coal and measured our gas. We ran day and day about, alternating in the same furnace, and continued the experiments for about six weeks.

Mr. E. Stein—Have you ever tested the consumption in a Siemens burner ?

MR. HEQUEMBOURG—A rated 50-feet Siemens burner consumes less than 25 feet.

MR. J. M. STARR—I believe you speak of getting gas in a sand rock. Is that below the limestone ledge?

MR. HEQUEMBOURG—I am hardly geologist enough to know.

MR. STARR—I have been told by parties who were sinking wells in your region that they went below the Niagara group of limestone rock; but I do not know whether or not the statement is correct. As the Niagara rock shows in our section of the country (Indiana), it is possible we might find natural gas in our locality. We are on the edge of the outcrop of the Niagara limestone.

A MEMBER—It is always found below the limestone belt.

MR. HEQUEMBOURG—Professor Ashburner, in his geological survey, gives a great deal of attention to such particulars. In his report he narrates all the known gas developments of Pennsylvania, and also gives the geological relations of the gas veins.

MR. STARR—I believe that the limestone rock dips deeper at Pittsburgh than it does in the Bradford region, and also is deeper there than at points on the Ohio river. Perhaps it dips to the south from Lake Erie. They are boring for the gas vein in the vicinity of Hemmingway glass works, and I believe their contract calls for a boring of from three to four thousand feet in depth.

MR. HELME—That argand burner statement is rather perplexing to me. What make of argand burner do you use? What is the number of holes, and what is the size generally?

MR. HEQUEMBOURG—It is an ordinary argand burner made by the Gleason Manufacturing Company, of New York City

MR. HELME—The strangest feature of the statement to me is that with an argand burner the gas will show 24 candle power; yet, as I understand it, when you consume the gas through a fishtail or batswing burner the illuminating value decreases to 8 or 10 candle power.

MR. HEQUEMBOURG—It is because of the fact that, owing to

the specific gravity of the natural gas, it is found impossible to burn five feet per hour when employing the ordinary burner. When you turn it on under pressure, instead of obtaining an increase of illuminating power you get a blue light.

MR. HELME—Have you ever tried a burner with a large slit —such as those used for the consumption of wood gas ?

MR. HEQUEMBOURG—We have tried the Bray burners.

MR. STARR—What was the result ?

MR HEQUEMBOURG—Rather unsatisfactory. We have never been able to get the higher results indicated save when employing the argand. As I said, ordinary burners generally show an illuminating power of from 8 to 10 candles. The best photometric test obtained by me with a common burner never exceeded a showing of 16 candles ; and I reaffirm there can be no question that an argand will indicate 24 candles.

MR. HELME—If we are all spared to meet next year, I would like very much to then have you say that you had experimented with a batwing burner having a wider slit. I would like to know whether the effect thus produced would not be equal to that now claimed by you in the case of the argand.

MR. A E. BOARDMAN—Have you, in making the tests, tried the sort of burner we have used in consuming wood gas—that is, an iron burner with a double slit ? That substitute might answer the purpose of the argand by furnishing an air space between the two gas openings. If you have no such burners, I will be glad to send you some samples which we formerly used down South when we were making wood gas. What is the specific gravity of your natural gas ?

MR. HEQUEMBOURG—About 800.

MR. BOARDMAN—That is even heavier than the wood gas.

MR. HEQUEMBOURG—One specimen of the gas was estimated at 822.

MR. BOARDMAN—With wood gas I have tried the lava tips, but found the same difficulty that you experienced with the natural gas—we could not force enough gas through, under ordinary pressure, to give a good light. If you decrease the

pressure sufficiently to prevent blowing, you cannot get gas enough to give the right degree of heat to ignite the carbon particles in the gas. I would like to know whether the natural gas will burn in a double-slit burner.

MR. J. C. PRATT—This may be a very interesting subject, but still it is one of very little practical value to the members of the Association, except to those who live in the neighborhood of these gas wells. We have, as I understand, several very practical papers, adapted by their subjects to interest practically all the members of the Association; and I think that further controversy on this particular topic should cease, so we may be afforded an opportunity of discussing the other papers to be presented.

CAPT. WHITE—I beg to differ with the gentleman. I think the subject of natural gas is one of very great interest to the gas fraternity; at least it is likely to become so, as natural gas is now being bored for in many sections of the United States, and also in Canada. I believe the members of the Association are anxious to get all the information they can about it; and therefore am inclined to think this discussion is very far from being a waste of time.

MR. PRATT—I had supposed that natural gas was peculiar to certain localities. I had no idea it was deemed likely that its use would be general throughout the country.

THE PRESIDENT—We wish to allow the largest latitude for discussion, and are anxious that any and every pertinent question may be asked about the papers which are read; but, of course, our time is limited, and we must proceed to the other work as expeditiously as possible. I will request any gentleman who may have further questions to ask on this subject to be as concise as possible.

MR. HARBISON—I would like to inquire whether the cause of difference in the illuminating power, as developed by the photometer and argand burner, is owing to any great variation in the amount consumed during the test? Does not the fact that the argand burner will consume the larger quantity account for the fact of the difference between 8 or 10-candle power by one test, and 24-candle power by the other test?

Mr. John Andrew—I would like Mr. Knowles, of Richmond, Va., to state his experience with natural gas.

The President—Is Mr. Knowles in the room?

Mr. Helme—Mr. Knowles desires to be excused. If there are any other papers I think we had better proceed to their reading.

ELECTION OF OFFICERS.

The President—Is the Committee on Nominations ready to report?

Mr. D. D. Flemming—Your Committee on Nominations would suggest the following names as officers for the ensuing year:

For President—Eugene Vanderpool, of Newark, N. J.

For Vice-Presidents—A. C. Wood, of Syracuse, N. Y.; Thomas Butterworth, of Rockford, Ills.; Malcolm S. Greenough, of Boston, Mass.

For Secretary and Treasurer—C. J. R. Humphreys, Bergen Point, N. J.

For Finance Committee—John Andrew, Chelsea, Mass.; William Cartwright, Oswego, N. Y.; Peter T. Burtis, Chicago, Illinois.

For Executive Committee—A. B. Slater, Providence, R. I.; J. H. Baumgardner, Lancaster, Pa.; D. H. Geggie, Quebec, Canada; Samuel Pritchitt, Nashville, Tenn.; James M. Starr, Richmond, Ind.; Benjamin Rankin, Louisville, Ky.

The President—Gentlemen, you have heard the report of the Committee on Nominations for the ensuing year. What action will you take on that report?

Mr. Harbison—I move the acceptance of the report.

The President—If there is no objection the report will be accepted. No objection having been made, the President, on motion of Mr. F. C. Sherman, directed Mr. George B. Neal to cast the vote of the Association in favor of the gentlemen named in the report of the Committee, and appointed Messrs. T. Littlehales and H. F. Coggshall as tellers to receive and report upon the ballot.

The ballot having been cast, the tellers reported, and the President declared that the gentlemen nominated were unanimously elected officers of the Association for the ensuing year.

THE PRESIDENT—Gentlemen of the Association, I have very great pleasure in introducing to you your next President, Mr. Eugene Vanderpool, of Newark, N. J. (Applause.)

PRESIDENT-ELECT VANDERPOOL—Mr. President and gentlemen, I thank you heartily for this expression of your consideration; I assure you I shall do all that I can to advance the interests of the Association, and I hope that I may be able, perhaps, a year hence to merit somewhat the distinguished consideration and honor you have now conferred upon me. (Applause.)

REPORT OF COMMITTEE ON NEXT PLACE OF MEETING.

THE PRESIDENT—Is the Committee appointed to select a place for holding the next annual meeting now ready to report?

MR. JOHN BALMORE—The Committee have unanimously agreed to recommend Cincinnati, Ohio, as the next place of meeting of the Association, and they also recommend that you appoint a Committee of Arrangements.

On motion of Mr. S. G. Stiness the report of the Committee was accepted, and the recommendation adopted.

THE PRESIDENT—The Committee of Arrangements will be announced at a later period. As we have now concluded with the present pressing executive business of the Association, we are ready to proceed with the reading of the papers.

FIRST DAY, AFTERNOON SESSION—WEDNESDAY, OCT. 15.

The President called upon Mr. E. McMillin, of Columbus, Ohio, to read his paper entitled

NOTES ON THE CHEMISTRY OF GAS MAKING.

In presenting this paper to the Association I have no thought of startling you with any new discoveries, and perhaps shall

say nothing with which most of you are not now familiar; but if I can only awaken a little interest in the mind of some member who is competent to more fully investigate the points here only reconnoitered, and that member shall at a future date give us something worthy of our calling, I shall have fully accomplished my purpose.

While I have given the questions here discussed a great deal of thought, and spent much time in their investigation, yet I regret that it did not occur to me to write on this subject until last week, and I then found myself too busy to be able to put the matter in a very readable shape, or to look up authorities, as I should and would have done had more time been at my command.

One of the troublesome compounds which both water gas and coal gas makers have to contend with is carbonic acid. The question of the removal of this impurity has cost the gas fraternity much thought and vast sums of money. Yet with all this expenditure of time and money we stand to-day where our predecessors stood—relying on the use of hydrate of lime for the removal of carbonic acid, or otherwise leaving it in the gas and, by the use of enrichers, making up for any apparent depreciation of the illuminating power. I personally know of but one exception to this rule—that of the Ann Arbor (Mich.) gas works. There Prof. Douglas succeeds in removing CO_2 by, as he supposes, occlusion in the earthy matter contained in a form of oxide of iron that he uses. Now, would it not be wise for us to investigate a little, and see if it is not cheaper to prevent the manufacture of this impurity than it is to remove it?

About the strongest argument the coal gas man has to present respecting the superiority of his product over that of the water gas, is the small per cent., comparatively speaking, of carbonic oxide in coal gas. But the percentage is not so small after all—anywhere from 4 to 12 per cent. Now, if the 25 to 35 per cent. of carbonic oxide is objectionable in water gas, the 4 to 12 per cent. in coal gas must also be objectionable, only in a less degree.

We all can readily understand how this compound is formed

when generating water gas. When steam is decomposed by incandescent carbon, about one-half of the volume of gas made will be CO. The proportion is afterward reduced by the introduction of the gas from the enriching substance. Now, do we so readily understand from whence comes our (say) 7.5 per cent. carbonic oxide in coal gas?

In selecting coals for gas making we are all careful to avoid coal containing a large per cent. of sulphur. But do we ever have the samples tested with a view of ascertaining the per cent. of oxygen? The gas works with which I am associated have experimented with a great many coals during the last year, and the ultimate analysis showed oxygen in these coals varying from 3 to 18.5 per cent. of the total weight. The latter figure looks large, and doubtless many of you are, like myself, a little skeptical respecting ultimate analysis of coal, owing to the fact that oxygen can only be ascertained by difference. But in practice we find that the quantity of oxygen present is quite as large, and varies quite as much, as the ultimate analysis indicate.

Now, while few give this question of oxygen in coal any thought, all strive for a coal low in sulphur. Yet, if I had my choice, to have the sulphur reduced one-half or the oxygen reduced in a like proportion, I should certainly accept the latter favor in preference to the former.

The form in which oxygen exists in coal is a question that has not been satisfactorily answered. Most authorities, I think, agree that it is present as water, either combined or hygroscopic; but as none of them are positive in their opinions, I will perhaps be pardoned for saying I do not believe that all oxygen is present in coal in the form of water, but that it is there partly as water, mostly in the form of compounds not unlike those holding it in woody fibre or vegetable matter, and a very small portion held by occlusion.

The average of 35 analysis of coal (the average made from tables given in "King's Treatise") give the following results: Carbon, 79.09; hydrogen, 5.32; nitrogen, 1.08; sulphur, 1.59; oxygen, 8.22; ash, 4.70. Per cent. of coke, 65.50. It is plain

from this average that but a small per cent. of oxygen is present in the coal as air; but the total oxygen is not large.

The ultimate analysis of a great number of samples of an Ohio coal that is extensively used in gas works, gives an average of 17.12 per cent. of oxygen; yet these same samples only gave an average of 7.26 per cent. of moisture. Now, from a number of analyses made of the gas generated from this coal (the gas before analysis having been passed through both oxide of iron and hydrate of lime—the latter supposed to be fouled, and used only to remove tarry matter), we obtained the following results:

NH_3	SH_2	CS_2	CO_2	Illuminants.	O	CO
.08	.08	.25	3.33	4.33	.58	9.58

A Pittsburgh coal that contained only .90 per cent. of moisture and 7.08 per cent. of oxygen, produced gas that from a series of analyses gave the following results:

NH_3	SH_2	CS_2	CO_2	Illuminants.	O	CO
.50	.80	.25	1.45	4.35	.65	4.00

You will observe that carbonic acid and carbonic oxide are found in the gas in almost identically the same proportion in which the oxygen is found in the coal. In testing the gas from the Pittsburgh coal, the gas was taken off near the retort, and passed through a small vessel filled with cotton; but it did not pass through either oxide of iron or lime. In making the tests samples were taken twenty-five minutes after the charge was put in the retort; again in two hours after charging; and again in 3¾ hours after charging in a four-hour charge.

Previous to making these tests I was under the impression that there was a larger per cent. of CO_2 and CO generated at or near the end of the charge than at the beginning; and I find that this is a common impression among gas men. This idea has doubtless grown out of the fact that gas of poor illuminating power is given off during the latter stages of the charge. These analyses show that at end of first half hour the CO_2 averages three per cent., and that during the last half hour it averages but 1.08 per cent. The CO at end of first half hour averages 7.25 per cent., and during last half hour it averages

4.17 per cent. These averages were made up from the tests made both from the Pittsburgh and Ohio coals. Samples taken about one hour and a half after a four-hour charge is introduced into the retorts will show these compounds present in about the same proportion that they are found when a sample is taken from the gas of the entire charge.

But the formation of these carbon compounds is by no means the only objection that can be raised against the use of coal containing a large per cent. of oxygen. In fact not more than thirty per cent. of the oxygen is taken up in this way.

The Ohio coal from which these tests were made yielded about 8,000 feet of gas per net ton of coal. The whole of the oxygen doubtless passes off from the coal in the retort, and possibly even more than is shown by the analysis, as a portion of the ash may be partially reduced. Now, 17.12 per cent. of 2,000 pounds equals 342.40 pounds, which sum represents the weight of oxygen in a ton of this coal. The oxygen in combination with CO_2 and CO in the 8,000 feet of gas from this coal will weigh about 100 lbs. The free oxygen in the gas (.58 per cent.) will weigh a little over six pounds. Then we have 342 pounds less 100+6 pounds, which equals 236 pounds of oxygen that must be driven from the retort mostly as water; for a comparatively small per cent. of the oxygen will be combined with the oxygenated compounds of the coal tar. In using this class of coal we have found it necessary to run fully fifty per cent. more water through our multitubular condensers than required with Pittsburgh coal, in order to cool the gas down to the desired temperature—the condensers being made hot by the condensation of the water vapor.

The volatile matter is greater in the Ohio coal producing 8,000 feet per ton than in the Pittsburgh that produces 10,000 feet to the net ton. Of course, it is much more difficult to keep up heats; or, in other words, to maintain heats it requires much more coke per 1,000 feet of gas made.

A majority of the gas works represented here to-day doubtless use coal from the Youghiogheny gas coal basin, and to such these remarks can have little application; but there are others here who use local coals, or coals that are bought for their ap-

parent cheapness, and to such I would suggest that it would be well not to lose sight of this question of the chemical composition of their coals, and to avoid those containing a large per cent. of oxygen.

Some authorities attribute the large per cent. of CO_2 and CO present in coal gas to over-exhaustion, which would draw these gases into the retorts from the furnaces. Were this assumption correct the per cent. of nitrogen drawn into the retorts would be much larger than the aggregate quantity of both CO_2 and CO.

The samples of gas taken for analysis (the results of which are given in this paper) were not drawn off by an exhauster; neither were they permitted to pass through any water or tar seal; but were driven out of the retort against a holder pressure of one and a half inches.

When Mr. McMillin had finished reading, on motion of Mr. Helme, a vote of thanks was tendered to the author for his instructive communication.

Discussion.

The President—I have put this motion with a great deal of pleasure, because I think Mr. McMillin has succeeded in presenting an extremely interesting series of statements; and has shown us the way by which we may make profitable researches into the minutiæ of our business. It would pay us all were we to make similar researches, provided we could spare the requisite time; but in default of our having the desired leisure, we are of course bound to acknowledge our indebtedness to the gentlemen who make these investigations for us.

Mr. McMillin will be very glad to answer any questions that you may desire to ask. We shall be very glad to have the matter discussed, if gentlemen desire any more information than the paper itself conveys.

Mr. E. McMillin—This is a paper, perhaps, not calculated to provoke much of a discussion, because its topics are of a nature calculated to be quietly thought over in order that they may be intelligently canvassed. There is one other statement that I would like to add to that which I have read and that is

—if you will calculate the number of feet of watery vapor which is passing off as oxygen, you will find that when using certain classes of coal, and only making 8,000 feet of gas per ton, there will be driven off almost as many cubic feet of watery vapor as of coal gas.

THE PRESIDENT—I would like to ask if you suppose that nearly all the oxygen is originally contained in the coal as water?

MR. MCMILLIN—I think not. I take the ground in my paper that the oxygen did not exist therein in the form of water. The ultimate analysis of the coal only shows about seven per cent. of moisture. Chemists tell us that you have to reach up to five, six or seven hundred degrees in order to get all the water out. The question then is, are you driving off the water, or are you driving off the hydrogen and oxygen, which at that temperature, combines to make water? The position I take in regard thereto is this—it exists there in a compound state, and not as water, and that the carbonic oxide and the carbonic acid will be in proportion to the percentage of oxygen contained in the coal. Many of the light coals in use in this country really contain a remarkable proportion of water. In one description of the Ohio coals formerly used by us, we obtained as water 15 or 20 per cent. of any given weight or charge carbonized; and that was in addition to the quantity obtained in the form of impurities. We do not use that sort of coal now.

MR. JAMES M. STARR—Do you suppose that the water found in the drip-boxes is a portion of that which is driven off with the gas during carbonization?

MR. MCMILLIN—My opinion as to that would be, no matter what sort of coal was used you would have about the same percentage of water in your drips. The gas resting over the water in the holder tank will, at a certain temperature, carry just so much moisture, no matter whether the volume so contained went into the holder with the gas, or was afterwards absorbed. Gas will take up two per cent. of moisture at a temperature of 40°; and at a temperature of 80° it will carry three per cent.

MR. T. LITTLEHALES—I think it is pretty evident the moisture that the gas takes from the tank settles in the drips. I have known of one or two cases where the purifier was put on outlet of holder, with the result that there was hardly any condensation whatever in the mains. This shows that the gas absorbs from the tank a large portion of water, and proves where the moisture comes from that settles in the drips. If the gas were thoroughly dry, of course there could be no such thing as condensation.

MR. WILLIAM HELME—Mr. Littlehales what was that purifier charged with?

MR. LITTLEHALES—In the case mentioned by me unslacked lime was the material employed.

MR. HELME—How often did it require to be changed?

MR. LITTLEHALES—It will be effective for quite a lengthy period.

THE PRESIDENT—If there are no further remarks to be made on this subject, I will request Mr. G. A. Hyde, of Cleveland, Ohio, to read his paper on

COATING GAS MAINS WITH COAL GAS TAR.

The practice of coating the outside of distributing mains with coal tar has been in vogue for very many years; but the dipping of such mains, thus ensuring the covering of every portion of the pipe, both on the outside and internally, is a method more recently practiced.

Tar coating was originally applied to the conduits intended as distribution mains for water companies; but manufacturers have within the last three or four years, unless otherwise directed, indiscriminately filled their orders by supplying the coated pipe.

Recently my attention has been directed to the destructive action of coal and naphtha gas upon the coal tar coating in the pipe, and also at the joints. This action has been of so serious a nature that I thought it advisable to bring it before the attention of the Association, to the end that the members might be put on their guard.

The gas coming in contact with the tar coating softens or dissolves it, and, when brought to a sufficiently liquid state, it runs along the main to the first convenient drip, where its deposit or collection causes a vast amount of annoyance, as it is not easily pumped therefrom without having been reduced to a sufficiently liquid condition by admixture with naphtha. Bothersome as this condition of things undoubtedly is, we yet have a still more serious state of affairs traceable to the same cause—leaky joints. In pouring the lead at the time of making the joints the tar is melted, and, being lighter than the lead, is carried to the upper portion of the joint, and prevents a perfect union between the lead and the face of the iron pipe. As soon as the gas is let into the pipe the action of softening commences, and, in due course of time—depending on whether there is little or much benzine in the gas—the tar is softened right through to the outer face of the leaden joint, and then occurs a leak which in length is about one-fourth of the circumference of the pipe, but always at its top section.

On motion of Mr. Starr, seconded by Mr. Knowles, a vote of thanks was tendered to Mr. Hyde.

DISCUSSION.

MR. J. H. KNOWLES—I think that the paper just read is true to the letter. I am running 20-inch mains now, and have to coat the pipe. I have been annoyed a great deal through the behavior of the inside coating.

MR. GEORGE D. CABOT—Some ten or twelve years ago I was very much impressed with the fact stated in Mr. Hyde's paper. In the season following the one when I had first laid the tarred mains I found that the whole of the coating was taken off by the action of ammoniacal liquor. It was a cause of very great annoyance to us. I will ask whether anyone else has had just that experience.

MR. JAMES STARR—I can testify to the fallacy of tar coated pipes. I would not put it on a single joint now. I always inquire if the pipe is uncoated ; but it appears that the manufacturers *will* send coated " tees" and " crosses." I always go to the trouble of even burning these out rather than using

them. Twenty years ago I made up my mind to try the "Robin's joint" coated pipe; as a result I had to open the mains at every joint. When repairing the joints the leaking gas, on ignition, would burn in a sheet of flame clear round the pipe, showing that the coating had been eaten off all around. The fact of the flame burning in that manner was conclusive evidence to my mind that the tar had been eaten away. In some cases where it had eaten through the lead the leak would exist at one point only; but in almost all defective places the joints leaked all around. Indeed, our leakage was frightful; we would make 200,000 cubic feet and sell but 100,000.

MR. J. P. HARBISON—Have you had any experience in leaking all round the joints except with the so-called "Robin's joint?"

MR. STARR—I have had no experience with any other tarred pipe save the "Robin's joint;" consequently I cannot say anything about the other descriptions.

THE PRESIDENT—Mr. Cabot, did you use a cement joint?

MR. G. D. CABOT—Yes, sir; the tar would affect the cement to such an extent that we could not put together a tight joint. We burned out the end of each pipe before we made the joint.

MR. C. H. NETTLETON—I have recently had occasion to take up quite a long line of 6-inch gas main that was laid in 1871. It was laid through a clean sandy soil where apparently there was no foreign mixture, yet, when the pipe was taken up, it was very thickly covered with rust; and in places the iron was very soft, so soft, in fact, that you could pick it with your knife. In connection with gas works I have charge of water works, and I have had occasion to take up water mains that had been tarred over. I have never yet found any tarred water pipe that was not perfectly hard, and with only small spots of rust here and there on the outside. It has occurred to me that if there was some way by which we could cheaply coat the outside of gas mains it would add to their life. As bearing upon that point I might relate an incident in my experience in connection with water works. Two water pipes of

different sizes were connected by a reducer—the latter was not tarred. After the water had run through this line of pipe about five years the reducer was taken out and found to be coated with rust $\frac{3}{4}$ inches in depth on the inside, while the tar coated pipe alongside of it had scarcely a particle of rust. This showed the particular efficacy of this tar coating to prevent rust in water pipes. If we could only manage to have our gas pipes covered with this tar coating on the outside, I believe they would last indefinitely.

MR. HARBISON—Was that pipe of lead or of cast iron?

MR. NETTLETON—Of cast iron.

MR. G. S. PAGE—I have had a wide experience in the sale of many thousand barrels of the *coal tar cement* which pipe makers have been using instead of coal tar; and this fact will explain the difficulty to which reference has been made by Mr. Hyde. I suppose that all the members have visited pipe works, and know how the pipes are coated. They are heated and dropped into a tank of tar; and as the pipes are open at both ends, they are, of course, coated both on the inside and outside. In the extraction of benzole, naphtha and light oils of the tar, which practice all our distillers follow now (these being more valuable than any other of the products), they carry the distillation far enough to take out the heavy oil also; and many of them carry it to a point of taking out the anthracene oil and leaving only hard pitch. In a large tar works which supply the pipe works with cement, this hard pitch is kept liquid by adding to it some of the heavy oils, but none of the light oils. This makes a product which runs about as cold molasses would from a barrel; and so, when the pipe is brought into the tank containing this cement, a thicker coating adheres than there would if it were thin coal tar, or pitch containing the lighter oils. Hence, in joining the pipes, when the lead is put in the pitch is softened. The pitch is left in the ends of the pipe, and the result must be just what has been stated. Mr. Nettleton has suggested a plan which I think it would be wise to adopt, and that is for all users of gas pipes to go to the parties from whom they buy their pipes and carefully inspect the way

in which they are coated. I do not see how there can be corrosion on the interior of the pipe unless oxygen is admitted; and I do not believe that many of the gentlemen present desire to sell much oxygen with their gas. If the pipe maker would put a plug in the ends of the pipe before plunging it in the tank there could be no coating on the inside; and if you would insist upon their using coal tar of a proper consistency, you would get a much better coating on the outside than is possible by the use of this cement coating made of hard pitch and heavy oils. It would last much longer and be much more effective. I presume, in the present state of the coal tar market, that is a point which could be impressed upon the pipe makers.

MR. E. MCMILLIN—I understand that Mr. Hyde's trouble was with the outside of the pipes.

MR. HYDE—Yes; with the spigot end.

MR. HARBISON—Do we understand from Mr. Hyde that his pipe was coated only on the outside.

MR. HYDE—This pipe was dipped pipe, every part of it inside and outside being coated; and it would not be possible to dip that pipe without getting tar on the spigot end. That is the disastrous part of it. You might get along with the melting of the tar in the pipe; but if, when you join your pipe, you have to go over the ground again it becomes a very serious matter.

MR. BUTTERWORTH—My experience coincides entirely with that of Mr. Hyde. For the last eight or ten years I have used no dipped pipes. In every instance where I did use them leaks occurred, and they had to be dug out. Three years ago, when laying a line of mains, I ran short, by a few lengths, of the desired quantity; to make up the deficit I borrowed from the water works a few lengths (it was coated pipe) and put it in. About three-quarters of a mile of that line of main was laid with pipe that had not been dipped; and the only leakage that occurred happened in the section laid with the coated pipe. There will always be a slight space left after the tar has been burned away where the joint will leak.

MR. STARR—I do not think that Mr. Page's idea of placing

a plug in the ends of the pipe when dipping them would answer the purpose, since this would allow of the tarring of the outside of the spigot—and there is where the leak occurs. If parties who desire to protect their pipe would, after its delivery on the ground, paint all of it on the outside up to, say, within a foot of the end, and then paint right around where the caulking is done, it would save trouble and could be done easily. I paint all my pipes in that way so as to cover the lead joint.

MR. O. B. WEBER—Mr. Roebling, the engineer of the Brooklyn Bridge, when he came to covering the wires that hold the span, did not use tar at all, owing to the fact that tar corroded the wire too greatly, but used white lead instead. At the Pittsburgh Bridge all the tar has been removed, and white lead substituted in its place. Mr. Roebling remarked to me that he thought the tar had such a strong affinity for the iron as to destroy it. He showed me a specimen where it had eaten in half an inch in a 3-inch coil.

MR. ROBERT BAXTER—I will state, for the benefit of those who desire to know a method of coating pipes with tar, the way we do it at our works. Before coating the pipes I heat them with steam. I have a wooden plug on the end of the steam pipe, and another wooden plug for the gas pipe. I turn on the steam, heat the pipe, and while it is hot paint on the tar. All of our new pipes are turned; and, of course, we do not tar the turned part. If we tar any of the old pipes which have spigot ends, we leave three or four inches untarred. When the pipe becomes cold the tar is dry, and, as far as my experience goes, it makes a tight joint. A few weeks ago I tried the same plan with a lot of iron pipes intended for services. I kept the steam on for about an hour and a half, baking the coating thoroughly on, and it made a really good job. We can both cut and screw this pipe without the tar scaling off. Of course, I cannot report this as the result of a long experience, since it is really comparatively new with me; but I intend to continue the operation long enough to give it a fair trial. I may say that some years ago at my works I had a

large section of main laid with 14-inch pipe which was coated both inside and out, and had the same trouble happen with that section as was alluded to in the paper—that of the tar filling the drips. There was no leakage from the joints, but still it was the last lot of pipe of that description used by us. All of our pipes are now coated with tar in the way that I have described, and I find it a very efficient system indeed.

Mr. Hyde—At East Saginaw, Mich., for the last two or three years, they have been painting service pipes in the way described by Mr. Baxter. This permits the tar to permeate every possible scale of the iron, and instantly makes a thorouhly glossy coating. It has not been tried long enough to know what the final result will be. The method has been followed only during the last three years, and a positive verdict cannot yet be rendered, but it gives now every indication of success.

Mr. Littlehales—For the last seven years every foot of service pipe which we have laid has been painted in that same way. I have carefully followed up the result, and have opened the same services year after year for the purpose of noting the effect. Some of the services that have now been down for seven years are as clean as they were the day when first laid. I am perfectly certain that the results of the practice infinitely more than repays the cost incurred for labor. I have figured out the cost as closely as possible, and find that it amounts to about one-quarter of a cent. per foot. In testing them you have this advantage—if there happens to be any imperfect welding you can discover it. We also do the same with our cast iron pipes. I do not care where they come from, or how carefully the foundry tests are made, defective pipes are often forwarded. We have had some delivered from the best makers in the country, but have never yet had a consignment in which there was not included more than one leaky pipe. I have had pipes with holes in them in which you could insert your finger; yet they had been passed as tested. The absence of leakage from such pipes in three months would more than repay the cost of testing and coating. I am perfectly certain that service pipes will last for ten or fifteen years under this process.

Mr. McMillin—I have been coating service pipes for the last thirteen years with a mixture of coal tar and turpentine. I do not use any heat in putting on the mixture, but give it time to dry thoroughly before placing the pipe in the ground. About two years ago I found a leak existing in an inch and a quarter service pipe, about four months after it had been placed in position. In fact it had been eaten away till it resembled a honeycomb. Upon investigating the matter the men acknowledged that it had been put in in an uncoated state. That shows the difference in the comparative lasting of wrought iron pipe, coated and uncoated.

Mr. Hyde—Did the coating prevent oxidation?

Mr. McMillin—It protects the pipe from the action of sulphur. It is very hard to protect a wrought iron pipe from the action of sulphur when it is laid in cinder, as the pipe to which I have referred was laid.

Mr. Hyde—In Cleveland, Ohio, we have found considerable difficulty with cinder. Our service pipes, when laid in cinder, were very quickly rusted through, honeycombed and destroyed. We are now laying the pipe in cement, making a trough big enough to hold the service, then filling in the cement, thus covering the pipe entirely. We could not find any tar or paint that would prevent the rusting out of services laid in cinder; but we found the plan mentioned to be a sure cure.

Mr. McMillin—The best thing that I have found for that is to use coal tar pitch. It will answer the purpose; but you must be careful not to use pitch that is too hard.

Mr. E. Lindsley—Some six or seven years ago, to the east side of our town was built what is called the "Viaduct"—some 2,500 or 2,600 feet long. We laid a gas main there just to supply the lights for that bridge or viaduct. I placed the pipe in a box one inch larger in square section than the diameter of the pipe, placing some strips beneath, and securing it by little wedges in the sides, leaving about half an inch all round and then filled that space up with pitch. The pipe lies right on a stone ledge—or a course of stone which projects about 8 inches inward—and is 22 inches from the top. On that ledge this

pipe is laid. It is therefore about 22 inches from daylight in that direction; and as it passes under the arches it is about 22 inches from daylight there. I have yet to find any corrosion, and have yet to find the first leak in any portion of the pipe.

Mr. Page—There is no question about the preservative qualities of pitch as a protection for iron. In 1870, in Paris, France, I saw gas mains, manufactured of sizes up to 24 inches in diameter, coated on the exterior with pitch, and then, before the pitch was cold, they were rolled in fine gravel. Recently, in Minnesota, I passed a factory where they are making the same kind of pipe. I should suppose that the cement used by Mr. Hyde would be cheaper than pitch, as pitch is worth $10 per ton, and the cement would be worth something less than that.

The President—If there is no further discussion on this topic we will now listen to the reading of the next paper.

Mr. H. F. Coggshall, of Fitchburg, Mass., then read the following paper on

PURIFICATION WITH IRON.—FIVE YEARS' EXPERIENCE IN THE USE OF CONNELLY'S IRON SPONGE FOR THE PURIFICATION OF GAS.

In presenting to you the results of my experience in the use of iron sponge, so called, I am aware that it is one of the subjects that will show in its economic results so small a gain in the matter of dollars and cents that it will interest but few of the members of this Association; and if it were not for the fact that there are some works represented here similar in size to my own, that will be interested in any subject presented tending to lessen the cost of production, however little, I should not intrude myself upon your attention.

In the fall of 1879 I purchased of Connelly & Co. 375 bushels of iron sponge. On the 1st day of December, 1879, I commenced its use, charging one of my purifying boxes with 70 bushels. The size of boxes is 6 by 10 feet, and 32 inches deep. Upon the lowest offset for receiving the screens I placed planks 1½ inches thick, filled with half-inch holes, leaving one

inch space from outside to outside of hole. Upon this I placed the sponge well wetted, filling the box full.

The results obtained were:—With the first box of sponge and two of lime, I passed 4,552 feet to the bushel. Two of sponge and one of lime, 3,545 feet. Three of sponge, 2,450 feet.

The number of feet run on the following charge were, respectively, 2,180, 2,000, 4,150, 4,350, 4,921, 5,360, 8,025, 8,000, 10,200, and 13,900; then running along at about 13,000 for a lengthy period without any falling off in the amount of gas purified. I am still using the same material as at first. The amount of gas purified up to October 13, 1884, was 51,389,000 feet, or 137,000 feet per bushel.

When we commenced using the sponge we were working with ammoniacal liquor in the first chamber, and pure water in the last chamber of the scrubber. I soon found I was having more carbonic acid than before, and also showing a decrease in candle power. At the suggestion of Mr. Connelly I shut off the pure water. and the candle power ran up to 16.80 without any enricher—this from Youghiogheny coal. I have used no pure water since.

From my own experience I am satisfied that equally good results will be obtained by everyone in the use of iron sponge, if they will comply with the following conditions:

1st. There should be ample quantity of material to give time for revivification between the charges. I had sufficient for six boxes of similar size to my own, as the increase in bulk, after first using, is quite large.

2d. All tar must be eliminated from the gas before passing to the boxes. This is very important.

3d. The boxes should be large enough to allow the gas to pass through slowly, in order to obtain the best results, as I found that, in passing 40,000 feet in 24 hours my runs were from 100,000 to 130,000 feet more than when I was passing 65,000 in 24 hours. This, of course, applies as well to lime purification.

4th. Plenty of air for revivification.

Complying with the above, I believe that everyone will be satisfied with the results.

The advantages obtained are—

Reducing the cost per 1,000 feet with the new material by 50 per cent.

Reducing the cost of labor 50 per cent., as the time required for charging, clearing, and preparing is no more than with lime. As proof of this, in November of '79, using the same coal and purifying with lime, I was passing to each box 220,000, 200,000, 217,600, and 216,000 cubic feet. After using the same lot of iron sponge for four years and a half, I am passing through 503,000, 477,000, and 433,000 cubic feet.

Last, but not least—doing away with the gas lime nuisance.

Now if, from the statement of the above results, some member of this Association is able to reduce his cost of manufacture, my object is attained.

On motion of Mr. Helme, a vote of thanks was tendered to Mr. Coggshall.

DISCUSSION.

THE PRESIDENT—This is an eminently practical subject, and is one on which we ought to have a thoroughly good discussion. There are plenty of members present who have tried iron sponge in various forms, and who can compare notes with one another to our very great advantage. I have never yet tried iron sponge in any form. We who are on the borders of Narragansett Bay have such an abundance of oyster shells at a nominal cost (having only to burn them with our breeze and the finest dust that we get from the coke, and with the expenditure of very little labor), that we can make lime so cheaply that it hardly seems worth while for us to change, except it be to do away with the nuisance which the spent lime creates. But I am aware many are so situated that the expense of the lime is quite an item in the economy of manufacture; and as there are several gentlemen with us who have made a thorough trial of the different methods of iron purification, we would all be glad to learn all that we can about the subject.

MR. WM. HELME—I would like to inquire of Mr. Coggshall

if he has run the material out until the sponge was entirely exhausted or worthless, and then figured out what it had cost him.

MR. COGGSHALL—I have not run it long enough yet to make it entirely worthless.

MR. HELME—You have been running it for four years?

MR. COGGSHALL—It will be five years on the 1st of next December. I will say, in relation to the lime nuisance, that at a short distance from my works is one of the streets of Fitchburg on which there are some very fine residences; and when the wind was in the west the effluvia from the fouled lime was carried to those houses, and was the source of very great complaint. The gas company was sued for a nuisance on account of this very matter.

MR. HELME—A gentleman who has been using the iron sponge for some time, and watching the thing pretty closely, and managing it, as I think, very intelligently, said that after he had passed 85,000 feet to the bushel through it, it was not worth much to him. Now, if he had paid 85 cents per bushel for it (which he did not do), that would have made the cost only one cent per thousand feet. He really paid for it about 60 cents per bushel. That is cheaper than lime would be in most places. We bought some six or eight hundred bushels to be shipped to Atlanta, Ga., and by using a little sawdust and lime in the bottom of the trays it was found to work very satisfactorily. We have not yet got to the point where we consider it exhausted; and therefore, while we are satisfied that we are saving something by its use, and especially a good deal of labor and trouble, we do not yet know how much *money* we are saving. That is a point which we all want to know about. My friend Boardman is operating a works at Macon, Ga., where he is using this material under greater advantages than we are, by reason of the fact that he has two distinct sets of purifiers.

MR. A. E. BOARDMAN—I have four sets—two for iron and two for lime.

MR. HELME—I suppose that, freight and all, the sponge

costs Mr. Boardman about 70 cents. That is about what ours costs us. I would like to have a statement of his experience in the use of the iron sponge. He has watched the thing closely, and has used it, I think, under the most advantageous system—that of having separate purifiers for the lime and the sponge.

MR. BOARDMAN—I will state in brief what my experience has been. When I first got the sponge I was greatly troubled to get lime enough to purify my gas. Noticing an advertisement of this sponge material, I bought a sufficient quantity to use in four of my purifiers. The works are rather small for the make we are sending out. The first lot of sponge that I received lasted me only about eighteen months; it then became so foul that I could not use it to advantage; and as we were at the time moving into larger works I obtained a fresh supply. During that period I had saved three or four times the cost of the sponge over what I had been paying for stone lime—which is the only lime that we can get at that distance from the seaboard. I averaged, on the entire lot, about six thousand feet to the bushel each time I tried it until at last it got down to purifying only two thousand feet to the bushel, when I got a fresh supply. The failing to purify was due not alone to the formation of fresh sulphur in the iron sponge, but it also became coated with the tar which went over (my scrubbers and condensers not being sufficiently large to throw it down), thus rendering it worthless. I then bought sufficient sponge to run my new plant, which is on a much larger plan than the old one—having 10 by 10 purifiers, I have been using the last lot purchased ever since (more than two years now), and I am at present purifying at the rate of between seven and eight thousand cubic feet to the bushel. It is not yet exhausted; in fact it has not shown any signs of exhaustion. It is doing better now than it did for the first few months after buying it. I also tried another experiment, being led thereto when I found out what caused the want of efficiency in the discarded lot. Having some retorts out of use I put that sponge in and reburned it. It reduced the bulk very largely, as all the sawdust which was mixed with it was consumed. I then took it

out, and, after cooling it, added a certain proportion of lime and sawdust to bring it to its original state. Since then I have attempted to use it. The only difficulty I now find with it is that it revivifies too easily, and I have had several cases of spontaneous combustion. I believe the material is practically indestructible, if used with proper precaution. I found, on one occasion, that in passing a large quantity of gas through the sponge I got an excess of moisture; in fact, on looking into the matter I discovered that the condensation going over was so great as to moisten the lower layer too much. I then interposed a screen of sawdust, and have had no trouble since. Before employing the screen of sawdust I had to change my boxes once a week, while now, even at this season, I require to change only once in three weeks, and in the summer season but once in four weeks. I had some difficulty in extracting the carbonic acid from the gas. If I did not feed water enough to the scrubber I was also very apt to get a little tar, which was, of course, detrimental. I am now running the four purifiers with iron sponge, and after passing it through three of them I pass it through two that are filled with lime. I find that this is a great benefit both to the gas and the sponge. I purify more gas with the sponge, and I also purify 32,000 to 33,000 feet of gas per bushel of lime. When the lime is taken out it has scarcely a trace of sulphur; and I suppose that if more care were taken to change, as soon as the middle purifier was fouled, we would have no trace of sulphur at all. But even as it is there is no nuisance from it. I would unhesitatingly recommend the iron sponge to all engineers residing in the interior.

Mr. J. Anderson—In connection with this subject I will mention that in our new works we have adopted a very simple method of keeping the sponge in the box; but I cannot state yet whether it will be a success or not.

Mr. G. B. Neal—My experience in the use of iron sponge is not precisely like that related by Mr. Coggshall. I have used that material for purifying (without lime) for nearly four years. The first lot that I purchased lasted about two years before it

became worthless. Acting upon Mr. Coggshall's suggestion, I employed lime with the sponge, as he has done, but not with very good results. At the end of about two years the initial lot of sponge was discarded. Then I purchased a new consignment of sponge which, at the beginning, seemed to work very well In some instances I purified as large a quantity as 18,000 feet to the bushel before revivification became necessary. The material since has been gradually lowering or decreasing in purifying power until it will now purify only three or four thousand feet per bushel. I am perfectly satisfied with it even at that. The labor of revivifying is very small. It is taken out of the boxes and spread on the floor, turned over once or twice, and, after remaining exposed for a certain length of time, is put back again in thorough condition for use. I use sawdust on the bottom screen in purifiers, and place over the sawdust the gunny bags in which the sponge was transported to my works. This is done to keep the iron sponge from mixing with the sawdust, and preventing waste. When we clear the sawdust out there is very little iron sponge mixed with it. The sawdust is changed but very seldom. The ammonia present, as shown by the test of our State Inspector, is always a trifling matter. The sulphur has varied, and at times has reached to over twenty grains. Twice I have been in danger of being held liable to a fine of $100, because of this excess of sulphur; still I may note that that state of affairs was owing to the sort of coal carbonized. When I changed the coal there was no further trouble from sulphur excess. I have had as low as six grains of sulphur in a test, and sometimes as high as sixteen. There is no difficulty in removing the sulphur. With regard to the carbonic acid, I am told by our State Inspector that the tests sometimes show the presence of carbonic acid, which certainly lowers the candle power. I do not lay any great stress on that, since I find that, without the use of an enricher, I am making five feet or more to the pound, and the inspector's tests invariably show an illuminating power of over sixteen candles.

MR. McMILLIN—What coal do you use?

Mr. Neal—I use the West Virginia coal. I have used the Youghiogheny and other coals. With the West Virginia coal I have no trouble. With the use of a trifling percentage of an enriching agent I can, and sometimes do, bring up my candle power to pretty high figures. I like the iron sponge very well; and, as I have already said, I would not be willing to change it for lime. I do not think the presence of the carbonic acid is any serious objection, owing to the large yield and high candle power obtained. The labor, as I have stated is very small; and, indeed, I fail to see any objection whatever to the use of iron sponge. I do not know how long it will last; I have used the lot last purchased for two months, and I expect it will last a good while longer. Its capacity to purify seems to remain at between four and six thousand cubic feet to the bushel, I can recommend its use even to those who are located near the seaboard where oyster shells are comparatively abundant, and more especially to those who are further inland than our situation in Charlestown, Massachusetts. Even in Massachusetts the oyster shell lime which we formerly used was quite expensive, costing four or five cents a bushel, although I have purchased it at as low a figure as two cents. Provided I could purchase oyster shell lime at two cents per bushel I should still prefer the sponge, at least so long as it continues to give the satisfactory results that we are now obtaining from it.

Mr. Littlehales—During the first eight years of my experience in gas manufacture I used oxide of iron for the removal of sulphuretted hydrogen. I do not think it is desirable to use the oxide if you are not working more than four purifiers. My own experience, and that of a good many others, will scarcely endorse what Mr. Neal has said regarding the unimportance of the presence of carbonic acid. It is generally accepted as an axiom in England that about a candle or a candle and a half of depreciation in illuminating power will follow the method of purification by oxide of iron alone. The usual practice now is to have six purifiers, using the first two for extraction of the carbonic acid. I am now putting up six boxes for the purpose of carrying out that idea. We have

used oxides of various kinds—the manufactured oxides, and also the natural product. As a rule we find our experience goes to show that the natural product is cheaper in the long run. We use the material in various thicknesses, sometimes filling the box the entire depth. It can be very easily revivified without removal from the box. I have known cases where the oxide has not been taken out for eighteen months. In Toronto they have a very efficient method of handling the oxide, removing it only about once in three times, the intervening renewals being done with a blower and a jet of steam. If you blow in air alone the high temperature generated by taking up the oxygen and reoxidizing the sponge will overheat the purifying box; but the use of a jet of steam prevents anything of that kind from happening. There are many works in England where purification does not cost anything, because the oxide of iron when too greatly exhausted to act as a purifying agent has become saturated with sulphur to the extent of 45 or 50 per cent.; this saturation making it worth a large price to the manufacturer of sulphuric acid: in fact is worth one-half the price of natural sulphur. The labor item in purification can be reduced to a very small figure through following out the practice of renewal by the aid of a steam jet. I am now putting up six purifiers, 18 by 20, to carry out that idea.

Mr. Neal—I forgot to state one thing in relation to revivification by injecting steam and air. This method was employed by an assistant at my works. He attempted to accomplish that method, but met with a disastrous result. The interior of the box was brought up to a red heat, and the experiment was attended with considerable danger. I shall never again, in any works of which I may have charge, allow any one attempt to secure revivification in that manner. I allowed my assistant latitude in this matter to do as he thought fit, as I had had no experience in that particular method, and further owing to his having successfully pursued the plan in another works with which he had been formerly connected. I did not understand how it was that he made such a failure of it at Charlestown. I will say, further, that I have four purifiers (three in use and one out of use) in which I use nothing but the oxide; I would

not use lime. If I were building a new set of purifiers, or contemplated the erection of additional boxes, or had one or two supplementary boxes, I would then use some lime in order to take out any carbonic acid, bi-sulphide, or kindred impurity.

MR. HARBISON—Leaving out of question the necessity for some mode of changing the purification (with regard to cost of material, owing to location, and also the annoyance that the lime nuisance causes to a neighborhood), I would like to ask if any one present can give the result of five years' use of oxide. Could we obtain such a comparative statement we could determine at once the relative money-saving value of the one over the other.

MR. COGGSHALL—For the five years previous to 1879 the cost of purification (for material) footed up to $1,279; but then, again, the quantity of gas purified during the five years from '79 was very much greater. I have not got the exact figures with me.

MR. HARBISON—You do not know the cost per thousand feet for purification.

MR. COGGSHALL—No; $1,279 was the cost of lime purification for the five years previous to my using the iron sponge; and the cost of iron sponge for five years was about $250. As to the cost of labor, it is fully one-half less with the sponge. I have no doubt that Mr. Neal's trouble with the first lot of iron sponge worked was caused by passing some tar into it. I judge that to be the case, reasoning from my own experience. I wrote Mr. Connelly in relation to the carbonic acid, and in response he suggested I should not use any pure water, and that I ought to have passed more ammonia into the purifiers. I thought that I would do this pretty thoroughly, so I stopped using ammoniacal liquor also. I ran along in that way for about six months. The first effect developed was that tar was passing into the sponge, the result being that I had to throw away about twenty-five bushels of it. As soon as I made the discovery I again commenced using the ammoniacal liquor, and the trouble ceased. There is no tar passing over into the last section of the scrubber. I am satisfied it is very important

the tar should be taken out. If sawdust be used in the bottom layer it will take it out; but of course it uses up so much of the capacity of your boxes.

MR. HARBISON—What scrubber do you use?

Mr. COGGSHALL—It is a scrubber that I devised myself.

MR. STARR—Can you purify as much gas with the sponge in winter as you do in summer?

MR. COGGSHALL—I did up to last winter. In the summer months I have passed a million feet to a purifier. As I said in the paper, with the large amount used in winter as compared with the summer season, I did not get so good results; but at the same time the working was satisfactory. I have been using the same material for five years, and at present I am purifying with it nearly 7,000 feet per bushel. Last December the amount decreased, running down to about 6,000 feet. I supposed then that the material was getting exhausted, so I ordered another quantity; but the last consignment has not yet been put into service. I shall continue to work the original lot until it becomes unprofitable to do so. My mode of revivification (and here comes in an important item in this matter, as thorough revivification greatly increases its capacity) is to take it out of the boxes as soon as a purifier is changed; I then heap it up in a pile about three feet high, and let it stand for forty-eight hours. A laborer then turns it over, and continues the turning over process every morning until the mass is thoroughly cooled. When cooled properly it is ready for work at the next change. Having on hand material enough to make six changes, I can, of course, run it along for a lengthy period. I visited Holyoke, Mass., recently, and was told they had been using the sponge there without any success at all. The only reason that I could see for this was that they could not run it more than twenty-four hours. They had not enough material to revivify it. It was put back again into the boxes almost as black as it was when it was taken out. Without any relation to the lime nuisance, and as far as the profit is concerned, the cost is about half what the cost of lime would be at my plant. Its advantage, of course, is to be determined by

each company for itself, taking into consideration the relative cost of sponge and lime.

Mr. Boardman—I will answer the question of Mr. Harbison in respect to the cost of purification by lime in my case. I gave $1.10 per barrel for stone lime, unslaked; and I find that the cost of purifying by lime for the three months and a quarter just preceding the introduction of the sponge was greater than the cost of purification for the next twelve months, when using the sponge. I tried the experiment of revivifying in the boxes, and came very near losing a set of wooden screens. I do not want to try it again. I put in an inch pipe, and tried a half-inch jet of steam, which I thought was ample; although the bottom screen was not affected very much, the middle screen was almost entirely consumed before I discovered the condition of affairs. This experience cured me of all desire to repeat the trial.

Mr. Starr—I have been using iron sponge for about two years. When making alterations in the works some time ago I put in larger purifiers, and ordered quite a lot of sponge—about 800 bushels. I have now been working with that, as stated, for some two years. I have purified over 50,000,000 feet of gas with it. I use it in such a way as to have the benefit of the lime at the same time. I place on my lower screen a 4-inch layer of lime, and then cover it with burlap. That saves all the sponge. Then I put on two more layers of sponge, each layer about 10 inches in depth. The burlap saves it from falling through on to the lime; and the lime takes up almost all of the tar that would pass through. I take out the carbonic acid at the same time that I am purifying from sulphur. I find it to work very satisfactorily. In the winter I purify 5,000 feet per bushel, and 6,000 in the summer. That is the difference between my winter and summer experience. I make the lower layer one of lime.

Mr. McMillin—With the exception of about three months, last fall, I have not used any lime for sixteen years. I have used sponge with two boxes, with three, with four, and with eight. I have used it in works making three million cubic feet

per year, and in works making 140 millions. I would not use lime if one would give it to me. In one of the works where I first employed the sponge I have been using the same material over and over. So far as I know, we never throw any away. It shrinks a little through handling, and a portion of it may wash away; but the same material has been in use for ten years. It has been burned over half a dozen times. We spread shavings on the ground, throw the sponge on them, start them burning, and the desired end is accomplished. Before trying this primitive method of revivification we had a similar experience to that recounted by Mr. Boardman. Sometimes, though, through our plan of burning it we obtain an oxide which is not just the quality desired. I am inclined to the view that you do not get nearly as satisfactory results from reburning the sponge in retorts as when reburning it out of doors. In the largest works that I am connected with we are now using the sponge. We used lime there during three months of last fall (we first took possession of them then), because we were waiting for the completion of a new purifying house, and we did not propose to change from the lime system until this was done; therefore the purification was continued as it had been practiced by the former owners. We were employing four men to handle the lime material—to put it into and take it out of the boxes; also one team and a man to haul the spent lime away. It had to be carted to a distance of a mile and a half. In the winter time we were obliged to put on two extra men. The entire cost ran from $15 to $25 per diem. We began the use of oxide there during the first week of last December; and it only costs us now from 25 to 50 cents per day. We now have one man in the purifying house but two days in three weeks. From these statements you can easily see the difference, in our case, between the cost of using lime and oxide of iron. The boxes are 20 by 24. When partly foul, the box lid is removed, and the mass is allowed to remain untouched for 24 hours. At the end of that time a laborer, scoop in hand, enters the box, going right around the sides, and throws out a small quantity on the floor—just enough to enable him to start the operation of turning over the mass in the box. He commences

at one end and turns the whole mass right over ; it takes him pretty nearly all of one day to do this. The next day he turns it back the other way ; and so, without any jet of steam, or any air being forced through, it can be gotten all ready and in shape to have the lid replaced. But the lid is not put on yet ; the box may stand there uncovered one or two weeks before being adjusted. This plan, then, occupies one man two days, instead of five or six men every day, and wastes almost nothing of the material. You could not get me to use lime at all.

MR HARBISON—How often do you have to turn over the sponge when performing the operation mentioned ?

MR. MCMILLIN—I think that twice will be ample, if your boxes are large enough. If you want to use the box right off you would probably have to turn the material oftener; and the oftener you turn it the more rapidly will it exhaust. At this time of year we change about every two weeks ; and after we change we usually allow a week or ten days to elapse before we close the box. We allow the material to become quite clean, as it costs nothing to do it.

MR. STARR—Do you do that month after month ?

MR. MCMILLIN—Month after month; and about once in three months we throw it all out, so as to clean the trays. So far the passage of the gas through the material does not appear to have hurt it at all. After a while it may become so fouled that it will not purify the gas; but thus far it has done its work perfectly. The boxes we use are 3 feet deep, and the lower tray is 4 inches from the bottom. The three boxes, after they have been running for three weeks, will give about a quarter of an inch back pressure to each, or three-quarters of an inch to the whole. We use the sponge perhaps under more advantageous circumstances than most men do. We have four boxes, 16 feet square.

MR. G. S. PAGE—There are three points in this discussion which are of peculiar interest. First, economy in the use of the oxide; second, the improvement in the purification of the gas; and third, the value of the product or residuum. At present, in this country, the exhausted sponge possesses no value.

I had occasion, some three years ago, in connection with two gentlemen from Manchester, England, to look into this matter. They wanted to purchase this oxide, containing from 50 to 60 per cent. of absolute sulphur. As we went from pile to pile, in our investigation, we discovered heaped up in the vicinity of various gas works at least 600 tons of sulphur contained in the waste oxide. It has been accumulating in all parts of the country; but I cannot discover that it has been as yet made a source of profit to our American gas makers. The receipts for this residual on the other side are in the neighborhood of a total of £100,000 per annum. The question becomes important, in view of this fact, how the sulphur in the spent oxide can be made available here. It could be done in the usual way, by burning the sulphur and making sulphuric acid. The process, as I have witnessed it in England, is something like this: The oxide is fed into an oven on an inclined plane, and spread therein to a depth of about two inches. A rake is then moved automatically to and fro, and you can plainly see the flames of sulphur burning off. The fumes are conveyed from there to the sulphuric acid chamber. Inquiries are now being made by the manufacturers of sulphuric acid concerning this mode of obtaining sulphur—not at $28 or $30 per ton (which is the price of brimstone), but for from $2.50 to $8.50, which is about the price in England for the oxide containing 50 per cent. of sulphur. I have no doubt, if this spent oxide sponge you are now using were put to one side, it would retain the sulphur, and be just as valuable a thousand years from now as it is to-day; and by and by it may come in and help to pay the dividends.

Mr. F. C. Sherman—As I understand it, many members have abandoned the use of lime, even when they prefer it, and are using the iron solely because they wish to avoid the spent lime nuisance.

The Association then adjourned, to re-assemble at 10 o'clock on the following morning.

SECOND DAY, MORNING SESSION—THURSDAY, OCT. 16.

The Association was called to order at ten o'clock on the morning of the second day by President Stedman. Mr. S. G. Stiness, ot Pawtucket, R. I., thereupon read the following paper, entitled

A POSITIVE CURE FOR CHOKED STAND PIPES.

Gentlemen of the Association:—Among the many questions which have pressed themselves upon the attention of the practical gas manager there is none, I think, of more importance than the subject of choked stand pipes—these nuisances presenting themselves, as they do, in season and out of season, and as a rule making their appearance most often at a season when we would be most pleased to be relieved of their presence, to the end that we might have our minds freed from a burden of anxious and vexatious care, and the muscles of our firemen saved from the strain of an extra and severe duty. All the ingenuities of active and earnest minds have been engaged for many a year in the attempt to solve this perplexing problem; and I may add that frequently, when I have been permitted to witness the operation of relieving a choked stand pipe, I have given expression to the thought that the freeing process was accompanied by language not in strict accordance with one's idea of a "proper line of prayer."

When our worthy Secretary first requested from me a paper on "a cure for choked stand pipes," I readily acquiesced in the suggestion, being all the more readily led thereto from the fact that I had been engaged in experimenting in that direction for several months, and happily with the most gratifying results. But when the printed notice of the Secretary came to hand I found that our friend had made an important addition to the subject as originally proposed, and the word "positive" had been added. Now, as I am rather partial to such a word as "positive," I must confess that I was not displeased at the addition, and particularly so as I am fully convinced that my experiments were in the right direction, and that if systematically carried out by others in their particular cases will prove a "Positive Cure for Choked Stand Pipes."

Early in September of 1883 I commenced carbonizing coal, in the ordinary operation of gas making, in a new bench of retorts fitted as follows: Arches, 7 ft. 6 in.; retorts, 14 in. by 26 in. by 9 ft.; all ascension, bridge, and dip pipes, 7 in.; hydraulic main, 24 in.; seal on hydraulic main of 1¼ in.; retorts heated by the Dieterich furnace system. Everything worked along in the most perfect and excellent manner until early in the following month, when, for the first time in all my experience of gas making, the perfect bliss of choked stand pipes was made known to me, "as part of the inheritance our fathers did bequeath us." To say that they were choked is to draw it mild—had the "Salvation Army" been within hail their services would immediately have been secured. I determined, if possible, to find the cause and prevent its continuance. In our examination of the matter we found that the hottest retorts were those in which the stoppages were most constant and persistent, and that next in order came some of the lower ones, where the ascension pipes were rough and not carefully cleaned, the cleansing operation being rendered all the more difficult on account of the readiness with which the tar or pitch adhered to them. We first tried a thorough cleaning of the pipes and mains, continuing on in that line for some time, and, of course, with good results. While the trouble was somewhat abated, still the cure was not *positive*. The next experiment was to remove the stand, bridge, and dip pipes, and these, with the hydraulic main, were all thoroughly cleaned out and made as good as new. After that for some time all went well. A recurrence of the stoppages prompted us to make an examination of the hydraulic main, and we found, under each dip pipe, a mound of what, by a stretch of imagination, might be called tar, but what I think was a dry, fine carbon, mixed with another substance, the two together making such a thick conglomerate muck that I had no desire to continue my examination any further in that direction. I then had the main cleaned out again, and determined to ascertain if this carbon, or soot, and pitch was caused by the high heat at upper retort, and accordingly placed in two dip pipes a cup fitted so loosely as to be easily drawn out. I soon found that the high heat caused

nearly all the deposit of dry material, and the lesser heat gave the more pitch. I continued the experiment many times, and found that while the other pipes rarely stopped, the one where the resistance was would stop after the second charge. I was then fully convinced that I had discovered the cause in that the heat of the retort was the chief sinner. Having found the cause, the next step was to find the "cure positive for choked stand pipes."

Many inventions had been tried, and among those one put forward by a member of the British Association of Gas Managers. This gentleman claimed that by placing a guard at the mouth of the retort he prevented this deposit, and in his paper on the subject said: "The higher we get the heats in the retort, the more cessible become the particles of disintegrated carbon and other dry substances which are constantly being made, and drop from the inside of the retort." And this is undoubtedly true, as in passing over, these particles must be deposited directly under the dip pipe, causing increased pressure on the retort, and finally ending in choked stand pipes. As we are not informed of the universal adoption of the plan as suggested by the English engineer, I fear that it lacked the one essential element—and that element the one expressed by the word added by our Secretary to the original question.

As misery likes company, I visited the works of the Providence (R. I.) Gas Company (believing that they were in possession of a *limited* portion of the inheritance so generously bestowed on others), to talk of my hopes, trials, and almost despair; but nevertheless, fully believing that I was traveling in the right direction, in the construction of a hydraulic main in which all the heavy products of distillation would, by the laws of nature, be carried to the outlet, to be removed therefrom by the aid of any of the common means now employed.

While discussing the matter with Mr. Hutchison (Superintendent of the West Station) he described to me a plan which he wished me to try. Believing that it would answer all the requirements in the case, as demonstrated by my experiments, and having the further advantage that it could be applied to any form of main now in use, I immediately commenced to

put the apparatus [here the speaker referred to the drawings] in position. Its function is to remove all the tar from the hydraulic main, leaving nothing for the gas to pass through in the main save water. From the time of putting up this crude apparatus (in the way of experiment) choked stand pipes are only known from the same cause that prompts nature to inflict punishment on mankind.

And now, gentlemen, I feel I can claim that by the adoption of a hydraulic main (an illustration of which is presented with this paper, and of which it forms a part; and further that there is no "patent" on it—if there were I should not be here to present it) in which the tar deposited must flow to the outlet placed on bottom (if the tar be too thick to flow easily means can readily be taken to accelerate its passage) choked stand pipes will be a thing of the past; and the gas being allowed to pass through water only, less resistance will be encountered resulting in the reduction of pressure on the retorts.

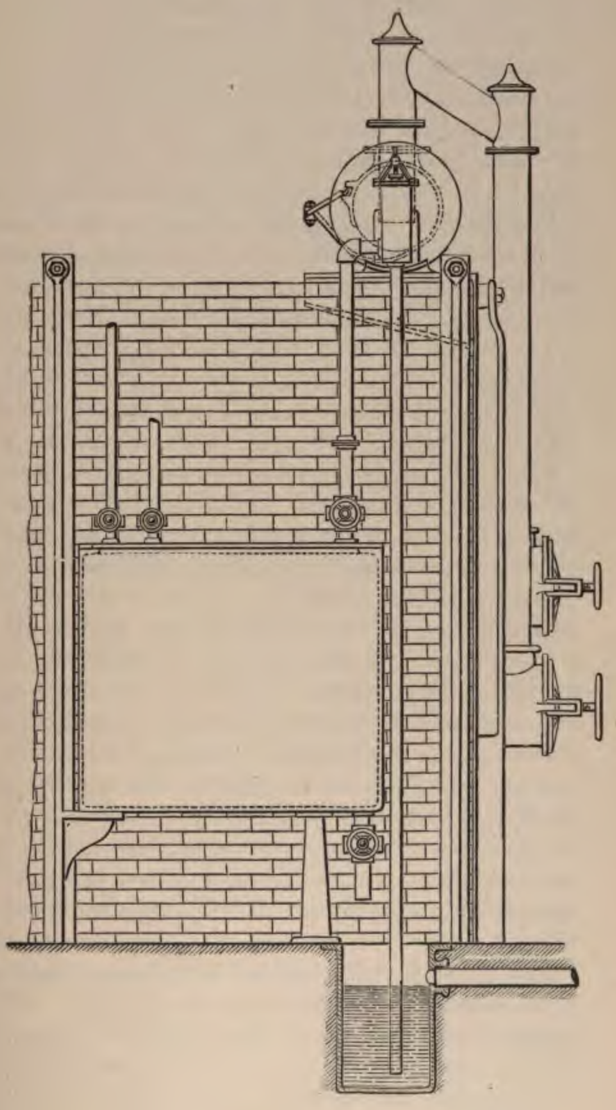
The application of the apparatus devised by Mr. Hutchison can be made to any main now in use. If a new main is to be erected on an incline, as per the plan presented in drawing, it will be perfectly automatic in its action and positive in its results.

If, after a careful examination of this subject, there should linger a doubt in the mind of any of my hearers that the problem is not yet solved, the matter is of importance, the field is broad, the gate is open, and the reward will be munificent—as the thanks of the gas fraternity will be generously bestowed upon him who truly solves the problem of "a positive cure for choked stand pipes."

On motion of Mr. Pratt, the thanks of the Association were tendered to Mr. Stiness.

DISCUSSION.

MR. STINESS—Before entering into the discussion with regard to the plan which I have here presented, I wish to say that the hydraulic main is made upon an incline of three inches in each section, and, by the natural laws of gravitation,



all of the tar must pass to the bottom of the main, and carried off by any form of tar gate which you may happen to have, or, in any case, can be easily obtained. The application of the box (or Hutchison device) can be made to any common main now in use. In the drawings which I have presented the tar is taken from the side of tar gate; but the particular place where the tar is taken from is of no material consequence. If the opening of the hydraulic main on under side be not convenient, it can be taken from the upper side. The apparatus which is herewith presented is not perfectly automatic in its working. This box is five feet long, twelve inches deep, and four feet high. Any desirable dimension of box can be made which will fit between the buck-staves on the bench of the retorts. The increased capacity of box increases the quantity of tar which it will contain, and also lessens the time of emptying the thick tar which will be deposited therein. The displaced water flows back to the hydraulic main, thus keeping your seal always at the same point. Your tar gate remains the same. In case the tar is not drawn off as soon as the box becomes full, it flows over, taking its usual course to the drip of tar well. The size of box is immaterial; but the larger you have it the fewer times you will be obliged to open and close it. There is no outlet for any gas, the box being really a wrought iron tank. When the box becomes filled (the tar settling at the bottom) of course, the water will flow back into the main. The point of advantage which I claim, and which I think the gentlemen will willingly admit, is that in the first distillation of the coal when working at extremely high heats, particles of carbon are carried over with the gas, and the resistance formed by the thick tarry deposit is certainly greater than that offered by water. When the gas is passing through the tar the resistance is so great that the dry carbon deposits itself in the stand pipe at the hottest point, thereby choking the stand pipe. Then the tar is carried over and deposited in the hydraulic main directly under the dip pipe, there forming a mound of thick tar, dry carbon and other materials. The apparatus which I first put up in my works was simply an old tar barrel, with a two-inch hole bored into it, provided with an

outlet by which the tar was drawn off, and the very moment the thick tar ceased running and the water made its appearance, we closed that part and opened the other. This operation would not require to be done oftener than once or twice a day, other than in extremely large works. In my own works we now perform it only once a day; we find that to be sufficient. With the inclined main and the addition of the Hutchison apparatus I claim that the entire tarry contents of the hydraulic main can be displaced, leaving nothing to obstruct the passage of the gas save the necessary contact with water.

THE PRESIDENT—A general discussion of this paper by Mr. Stiness is now in order. I think that there are many members of the Association who have not yet gotten over the difficulty of stopped stand pipes attendant upon the running of very high heats.

MR. A. B. SLATER—In Mr. Stiness' description of the tar box he failed to make clear one point in reference to the water in the box. Unless I misunderstood him he did not state that the box is to be filled with water to start with, but that as the tar came from the hydraulic main the water was displaced by the tar flowing into it.

MR. STINESS—I did not state that in my paper, for I supposed it was matter which would be drawn out in the course of the discussion. In placing the box upon an ordinary main, of course, it must be filled with water up to the level of the hydraulic, so that you would not in any case unseal the main. After the box has been once filled, then each time the thick tar is drawn off the box must be refilled with water. In placing the apparatus on an inclined main, after the box is once filled it is perfectly automatic in its arrangement, and will not require to be filled again, because the overflow from the water is passing into it at the same time that it is passing out from the hydraulic seal.

MR. J. M. STARR—In the fore part of the paper you spoke of having an inch and a quarter seal when you started working with the apparatus. What seal do you carry now?

MR. STINESS—Just exactly the same. In no case has it been changed.

MR. STARR—Is not that rather too large a seal to carry? We carry three-eighths of an inch, and consequently have very little back pressure. A result of this may be that we are so little troubled with stopped stand pipes.

MR. STINESS—I use dip pipe valves upon my main. Immediately upon charging we raise the valves, and therefore we carry a little heavier seal for the short time in which the valves are not in use than we would if we were to carry a continuous sealed main. When the tar gate was first placed upon the main it was located somewhat higher than we intended to have it, and we found by actual experiment that instead of a three-quarter inch seal, as we had proposed to work at, we had an inch and a quarter seal. In my judgment that was an error on the part of the machinist. Even with the valves we found that this heavy deposit of carbon would eventually choke up the hydraulic. We found that especially true, as we were running under pretty high heats. Our daily average yield per retort was a high one; but to be specific, for the year ending October 1st, 1884, the per diem yield per retort, without counting any missed charges, nor taking note of stoppages arising from the many causes which are so well known to gas men—on which occasions the retorts lie idle a great deal—averaged over nine thousand cubic feet.

MR. STARR—I infer then that you do not have any seal at all; or, rather, only while you are charging.

MR. STINESS—Only while we are charging.

MR. STARR—May that account for your not now having any stopped stand pipes?

MR. STINESS—We had stopped stand pipes even from the first. The valves were placed upon the hydraulic main when the works were built. The works are entirely new, and everything about the plant was new. We found in the upper retorts, which were decidedly the hottest, that this accumulation of thick tar was directly under the dip pipe, and sometimes was

so great as to fill the dip pipe up beyond the opening of the valve itself when it was raised. We took the under plates off from the hydraulic main several times during the winter, stopping the entire works to accomplish this result. In the experiment which I spoke of—that of placing the tin cup in the dip pipe—we found that the dry carbon deposited itself directly in the cups when so placed. The cups were pierced for the flow of the gas, and in the dip pipes in which they were placed that deposit was made even at the very outlet of the dip. With the lower retorts, even where we decomposed the oil for enriching, we found but very little deposit directly under the dip pipe. This apparatus has now been in use for over eight months, and we have never changed the plan of working it during that time. We know from repeatedly taking off the hand plates, and from taking out the plugs on top of the dip pipe, that we have no thick tar nor any accumulation in the bottom of the main sufficient to amount to anything. Its presence could be easily ascertained by taking out the plug of the dip pipe and running a bar down through it.

MR. W. R. BEAL—Having worked a great deal to prevent stopped stand pipes, I trust that I may be pardoned for giving my experience on this subject. Ten or twelve years ago I was in the habit of making eight to nine thousand feet to the retort, per day. I think that any one who has had a similar experience or anything like it, has had all the difficulty that Mr. Stiness refers to, and perhaps more; but it is very queer that my next door neighbor, who has been making (with but a single bench) this summer 55,000 feet to a bench of sixes—and not large retorts at that—has had no trouble at all in his main; and most of you who have approached anywhere near such a record have had a great deal of difficulty, not only with stopped stand pipes, but also with stopped mains. I have said that my experience with stopped stand pipes and stopped mains has led me to do a good deal of hard work in wrestling with the whole subject. I cannot agree with what Mr. Stiness has said about the best form for the hydraulic main. There is no question but that the main which he describes affords a sort of relief so far as stopped stand pipes are concerned. I

am now, and have for many years, been using a main which is calculated to alleviate this difficulty. This main may be cleaned out at any time without stopping the make of gas. It has an overflow from the bottom by a four-inch pipe; and this main can not only be cleaned out, but can be drained fairly well. In our experience, however, we do not find that any system of drainage can be depended upon. We find that as we manufacture gas the pitch and the heavy tar (and by heavy tar I mean that which will not run) is formed, and that it stays where it is formed, and has to be forcibly removed. No coaxing that we have been able to effect will induce it to run out. As I have said, we have a four-inch pipe to drain the bottom of the main, and although that facilitates getting the tar out, I do not think very much of it. But as for a main that may be cleaned out at any time, and without any danger, there is no question about it being a valuable apparatus for a gas works, and a preventive for stopped stand pipes.

MR. M. S. GREENOUGH—I agree very thoroughly with what has been said by the gentleman who has just taken his seat. We have at our works recently conducted a series of experiments, with a variety of regenerator furnaces, some of them of our own device, and some that have been imported from the other side. We have been "enjoying" all the disadvantages of stopped stand pipes, and know just what they mean. We appreciate all the difficulties to which Mr. Stiness has so touchingly alluded. We have come to the conclusion that in order to work regenerator furnaces satisfactorily it is necessary to be able to get into the main. I do not think it will be possible to induce the pitch—which will sometimes result from very great heats, and which heats you will occasionally get from working regenerator furnaces—or lampblack to run off. The worst difficulty we have experienced has been the stopping of the dip pipe with lampblack; and the only way to get that out is to let it run down into the main—allowing it to go off into the tar well, with the effect of stopping that up solidly. We have had to let down twice in order to clear out the main. Some years ago some friends and myself had the pleasure of visiting the gas works at Dresden, and saw the regenerator

furnace system in use there. The engineer there at that time showed us a hydraulic main which he had devised for effecting the purpose now under consideration. He had a piece of iron plate which came down from the top of the main, partitioning off the back part from the part in which the dip pipe is sealed. It was so arranged that, without stopping the works, he could take off the plate from back of main, and so remove any pitch which might have accumulated under the dip pipes. It was from seeing the satisfactory results of his plan that we set ourselves at work to devise the hydraulic main we now have in use, and which we thought would be a little better in detail than his. I am inclined to think that the annoyance of stand pipes stopped by pitch can be entirely obviated; but I do not think that anything can prevent the stopping of your stand pipes with lampblack, when your retorts are run at too high a temperature. I do not think that the question of stopped stand pipes has been altogether solved as yet. I have seen more retorts stopped with pitch at a somewhat low temperature than have been stopped with lampblack at a high temperature. To devise an equitable temperature, and to determine exactly the weight of charge with which a large retort can be worked, without stopping the pipes with either pitch or lampblack, is a problem which I do not think has been solved as yet. I shall be very glad to learn how to do it.

Mr. Stiness—I would like to ask Mr. Greenough the question—knowing of the experiments he has been making in that direction—if a main were constructed on an incline sufficient to permit of the automatic removal of a certain portion of the thick carbon matter, thus leaving nothing but water for the gas to pass through, would not that be a step in the direction of removing the cause of stopped stand pipes?

Mr. Greenough—I have no doubt about it at all. I think that the largest proportion of the difficulties from stopped stand pipes arises from excess of pressure, and that the removal of the heavy tar would have a most beneficial tendency. It seems to me that the scheme of an inclined main is not altogether practicable. If you are going to run a setting of eight benches of

retorts together for any length of time, it might be difficult to draw all your tar off upon an incline.

MR. STINESS—It might be allowed to run both ways from the center, could it not?

MR. GREENOUGH—That might possibly be done. On the benches that I have been experimenting with we have been running off the thick tar from the bottom of main as best we could; but still we could not run it all off by any possibility. I do not think we can solve our difficulties until we are able in some way to clean out the main thoroughly.

MR. M. N. DIALL—I have seen a main having a secondary chamber to the one in which the dip pipes are; and the cleansing chambers were cut down so that this thick tar (oftentimes so thick that it cannot be removed from the top of the hydraulic by the use of even very ingenious tools), could be very easily taken hold of at the bottom.

MR. A. E. BOARDMAN—I think that Mr. Stiness has struck at one great difficulty—the difficulty of stopped stand pipes. I do not wish to seem egostistical, but I take great pride in saying that I operate probably the smallest works in this country in which a regenerator is in use. It is a works running but two benches of sixes; and I have had the same difficulty (which the gentlemen speak of) in regard to stopped stand pipes. I believe with Mr. Stiness that a great deal of the difficulty is caused by this heavy tar getting under the dip pipes; but I differ with him in believing that a main, even with three inches dip through a length of one section, is sufficient to carry off that heavy deposit. I agree with Mr. Greenough in thinking you cannot get that deposit to run excepting on a very steep incline; because, with my two benches, emptying the tar from both ends and from the bottom, I am unable to keep free my center dip pipes. They will stop up; and the tar will not run off without being moved by some extraneous force. I have just gotten up a main that embodies an inclined plane with a very steep angle (one of about 45°) from the front of the main towards the back, bringing the dip pipe in at the side, where it can be easily reached from the top of

stand pipe, and this heavy stuff can be shoved back into the main, and from there taken out in the manner described by the gentlemen who have just spoken. I do not think that Mr. Stiness has reached the cure for the evil entirely, even though the incline would allow all the heavy tar to run out of the main. After cleansing my main thoroughly I had stopped stand pipes again occur within two days, and before it was possible to have accumulated enough tar to stop up the dip pipe. These stoppages seemed to be owing entirely to lampblack. I think the heavy tar stoppages, which frequently occur in the cross saddle pipe, are caused by this accumulation; and I do not know of any means yet discovered which will keep the stand pipes from becoming stopped by a deposit of lampblack. I have taken out my stand pipes, and have substituted clean ones in place of them when I did not have time to clean out those so removed, but they would stop within two days, even when I knew that the main had been cleaned out only a few days previously, and when the tar was running through the main as fluidly as could be.

AN INVITATION TO VISIT THE PATENT OFFICE.

THE PRESIDENT—I have the pleasure of announcing to you that we are honored this morning with a visit from Major Dyrenforth, of the Patent Office, who is especially interested in gas matters, and I am very glad to welcome him to our meeting. Allow me to introduce him.

MAJOR DYRENFORTH—I thank you Mr. President and gentlemen for your greeting; and I would like to extend to you all an invitation to visit the Patent Office before you leave the city of Washington. Although the department offices are now undergoing some repairs, and everything that might be of interest to you is possibly not accessible, yet you may be able to see many things which would repay you for the visit. I will do everything in my power to show you whatever there may be worth seeing.

THE PRESIDENT—On behalf of the Association I accept the invitation with very great pleasure. We may not be able to

visit the patent office in a body, and it might embarrass you to have all of us come at once; but I suppose that the invitation is extended to the individual members as well as to the Association as a body, and that those of us that may have an opportunity to accept the invitation may visit the Patent Office?

MAJOR DYRENFORTH—Certainly. You can come singly, or by twos, or by threes, or in whatever style as may be most convenient.

THE PRESIDENT—If there is nothing more to be said on the subject treated of in the paper of Mr. Stiness, we will pass to the consideration of the next subject.

Mr. C. H. Nettleton, of Birmingham, Conn., then read the following paper on

THE PERIODICAL TESTING OF CONSUMERS' METERS.

During the past summer all the meters belonging to the Derby Gas Company, with which the writer is connected, were carefully tested; and, in the hope that a statement of the results obtained and the methods followed may be of some interest and usefulness, this paper has been prepared.

I presume it is so nearly an axiom with a gas manager that it is a good thing to test meters periodically, that no words of mine are needed either to prove it or to enforce it with the members of this Association; but as this paper will probably be published with the proceedings of this meeting, it is perhaps both proper and politic to state the grounds we stand on in relation to this matter.

It is always well for a manufacturer to know that his machinery is in good order and working properly; and in the case of the gas meter, standing as it does between the seller and the purchaser, and determining not only what the one shall charge, but also what the other shall pay, it becomes doubly important that this particular piece of machinery should be carefully watched. Besides there is a moral responsibility which most of us feel the weight of. Practically, consumers know nothing of meters; which is a very much to be regretted fact, for if they were "known and read of all men," are we not

all convinced that the great bone of contention, the great cause of difference between gas company and gas consumer, would be done away with ? Unfortunately this is not the case, and when a bill is presented the consumer pays it generally on the ground that it is about the proper amount for the season of the year, or is about the same as last year's bill ; or else scolds because it does not comply with the above conditions. But he does not pay it from any knowledge that the number of feet charged has been properly measured, and his belief in many instances is to the contrary. Under this state of affairs we owe it to ourselves, as honest men, as well as to our customers, to know that our meters register correctly.

If we are to know that fact our meters must be tested ; and if they are to be tested, how frequently shall it be done? Certainly not every month, nor once in three or six months, nor, in the judgment of the writer, every year. Possibly because almost all the gentlemen who have publicly called attention to this subject have recommended three years—certainly because that length of time commended itself to the judgment of the writer—he has followed in their footsteps, and tested those under his control for the second time during the past summer, the first testing being made in 1881.

From the results obtained the conclusion may fairly be drawn that the time is not too long, as most of the meters were correct, or nearly so ; and yet it would seem that a meter ought not to run for a longer period than three years without the manager knowing positively whether it was registering correctly or not.

In order to bring out certain facts, and for the purpose of making a comparison, the results of the testings of both '81 and '84 are given :

	Testing of 1881. Av. Age of Meters, 5.84 Years.				Testing of 1884. Av. Age of Meters, 7 Years.		
	Correct.	Fast.	Slow.		Correct.	Fast.	Slow.
Less than 1 per cent.	47	—	—		76	—	—
1 to 2 per cent.....		116	130			150	146
2 to 5 "		34	53			60	81
5 to 7 "		1	7			8	7
7 to 9 "		1	1			1	3
9 to 12 "		2	1			—	—
Would not register..				2			
	47	154	192	2	76	219	237

	1881.	1884.
Total number tested.......	395	532
New bellows put in........	45	68
Condemned................	4	—
Total cost................	$675.00	$816.00
Cost per meter............	$1.71	$1.53

The above does not include the meters on hand, but only those in actual use. It will be noticed that in both cases the larger number of meters run slow. Exactly, the testing of '81 shows the average of all the meters to be 0.06 of one per cent. slow, and that of '84, 0.03 of one per cent. slow.

Expressed in percentages, the above table gives—

	Testing of '81.	Testing of '84.
Percentage correct.................	11.9	14.3
Percentage varying from 1 to 2 per cent.	62.3	55.6
" " " 2 to 5 "	22.0	26.5
" " " 5 to 7 "	2.0	2.8
" " more than 7 "	1.8	.8
	100	100

The plan under which the meters were tested is as follows: The services of a good meter repairer are procured, and he is set to work at the meters on hand. Papers like the following sample are filled out—one paper for each meter—giving the description of the meters already in use; and these are arranged by streets:

................GAS COMPANY.

....................188

Test Meter.

Order Number ....

Name..

Premises......................................

No. of Meter..................................

Company's Number ....

Size..

Maker...

Index ....

Percentage fast or slow.......................

State if corrected............................

Repairs made..................................

No. of Meter set..............................

Company's Number..............................

Size..

Maker...

Index...

Date when done................................

Done by.......................................

Entered—Order Book,	Page	......by......	
Consumer's Ledger,	"	......by......	
Statement Book,	"	......by......	
Collection "	"	......by......	
Meter Record Book,	"	......by......	
Meter Test "	"	......by......	
Location "	"	......by......	
Manufacturer's Record,	"	......by......	

A gasfitter then takes the papers for a certain street or section of a street, selects a load of a dozen or more meters corresponding in size with those on the papers, and which have been already tested and repaired, and starts out. As he enters a house he takes with him a meter of proper size; but before taking down the meter already in use he checks on the paper referred to its description—*i. e.*, the number of meter, com-

pany's number, size, and maker, and also sets down the statement. He then sets the new meter, and after it is set writes on the same paper before mentioned its description and its statement, then fills in the date and his initials, and goes out, carrying with him the old meter. In this way but one visit is made to each consumer. When the entire load of meters has been set, he brings those taken out to the meter repairer. The latter reads off the statement of each meter, and checks the same on the corresponding paper. The meters are then tested carefully, and all necessary corrections and repairs are made, and the hands on all the meters, up to and including twenty lights, are set back to zero. This last is done to avoid mistakes, and to satisfy consumers that no mistakes have been made when the next bill is presented. The meter repairer enters on each paper the percentage fast or slow, and if he corrected the same, and what repairs, if any, were made. These papers are then taken to the office, and entries are made on the different books; and as each entry is made the person making the same fills in the page of the book and his initials at the bottom of each paper.

It is but proper for me to state that this paper is copied almost entirely from those in use by the Providence Gas Company, to whose genial manager, Mr. Slater, I am under very great obligations both for this and many other favors.

Naturally the question will be asked does it pay? Here is an outlay of $1.50 on each meter, to say nothing of the annoyance and trouble in the office caused by the change. In reply the writer can only give his individual opinion that it does pay —perhaps not directly, but indirectly he believes it yields a handsome return. The meters which have commenced to gain or lose are checked in their career, and the manager escapes, on the one hand, the annoyance of being compelled to test the meter by the complaints of his consumer, and perhaps the mortification of finding it exceedingly fast; and on the other hand, he escapes the loss caused by meters running slow, and which may continue so long as to become a serious drain on the finances of his company. Personally I would rather have

fifty meters tested than to meet in a single case with either experience.

Besides, I can but believe the moral effect on the consumer is good. He sees the gas company not satisfied to let matters take care of themselves, but trying, entirely at their own expense, to ascertain if their meters are correct; and if he be a fair man his respect, and with it his liking for the company, must increase.

Before closing this paper I desire to call your attention to a matter which has never to my knowledge been alluded to in any paper read before this Association, and that is the method of keeping a record of the meters used—the work done by each meter, its life, repairs, testings, etc. Previous to adopting the system which he has now the writer had a very unsatisfactory method which gave no information whatever—and he hailed with a great deal of pleasure the system which originated with the New York Society of Gas Lighting. This system of meter records was reported to the Society, in July, 1876, by a committee consisting of Mr. A. M. Smith, of the Manhattan Gas Light Company, Mr. Wm. Farmer, of New York, and the late Major Geo. W. Dresser.*

In the language of the minutes of the Society "the committee were to devise a system of meter records by which it would be possible to trace the entire history of each and every meter from the time it was bought until it was condemned."

The principal feature of this system is the adoption of what the committee call the "Company's number." Quoting from the report of the committee: "Each company is to number all meters received consecutively by a small brass stamp soldered on to the case when first received at works. In case of meters on hand and in use the numbers to be attached as they come in for test or repair. These numbers to remain during the life of the meter, and when the meter is condemned, the num-

* Since writing the above it has come to the writer's knowledge that this system of meter records was designed by Mr. Eugene Vanderpool and Mr. J. P. Dusenberry, the President and Secretary of the Newark Gas Light Companyl and had beeu used by that Company before this report was made to the Society of Gas Lighting.

ber to be condemned also—*i.e.*, never used on another meter. This number to be the index for identification of all meters."

I think it will at once occur to every one present that this system of numbering meters is a great convenience. Perhaps an illustration of their service in one instance to the writer may enforce the point. When the testing of the meters had been nearly finished last summer it was a little uncertain if all the meters had been brought in, and to ascertain the fact a sheet of consecutive numbers was prepared from one to the number of the last meter purchased. The number of each meter which had been tested was then read off from the papers used by the meter repairer, and checked on the sheet of consecutive numbers. When all had been read the numbers not checked were the meters which had been previously condemned, thus showing that all the meters belonging to the company had passed through the repairer's hands. It can readily be seen that the information was obtained in a very short time and with very little labor.

The principal books recommended to be kept by this committee are as follows, and the language of the report is again quoted :

"The Meter Record Book, ruled as per paper A, will show company's number, maker's name, maker's number, size, kind, date of purchase, location (meaning page in Location Book), when repaired, why repaired, by whom (these four items repeated), when condemned, length of service, remarks. Location of Meter Book, ruled as per paper C, will have an appropriate space allotted to each street by itself to show where the service is performed by each particular meter.

"Meter Test Book, ruled as per paper B, will have an index book accompanying it, with company's numbers running consecutively, and showing date of test for each number, which will, by reference to that date in Test Book, give all particulars of test. This book will run according to date.

"Record of Makers, ruled as per paper D, to show duty performed by each particular meter."

As the writer had no voice or hand in devising this system,

and was not a member of the society when the report was made, he hopes it will not be considered out of place if he devotes to it some words of praise. After using this system for nearly three years, I can only say that which is in its favor. If it have any weak points I have not found them. It accomplishes perfectly what the committee intended it should—it traces the entire history of each and every meter. Every question, or almost every question, in relation to any meter can be readily answered by referring to one or other of these books. It can be truly said of it that it is a splendid system, well thought out.

In conclusion, gentlemen, what I have tried to show is that it is desirable to test meters periodically—that when they are so tested at not too infrequent periods, that most register correctly, and the variation of all meters from that point is so slight as to do but trifling injustice to either consumer or gas company, and further, that a system of meter records can be easily maintained by which the life of each meter can be fully written in a few words and figures.

On motion of Mr. Starr a vote of thanks was tendered to Mr. Nettleton.

THE PRESIDENT—Another gentleman has also contributed a paper on this same subject, and perhaps it would be as well now to listen to its reading, so that this discussion might be made in conjunction with whatever new features are developed in the second communication. If no objection be offered to this course I will call upon Mr. E. McMillin, of Columbus, Ohio, who is the author of the second paper on this subject of meters.

MR. EMERSON MCMILLIN—It seems almost unnecessary for me to present and read the paper I had prepared on this subject, since the ground has been fully and carefully covered by Mr. Nettleton. It seems to me that my paper would be only but a confirmation of what he has already stated. I must add had I known that Mr. Nettleton was engaged in the preparation of any such paper as the one presented by him to-day, I would not have prepared mine. His is certainly one of the

most carefully prepared communications that I have ever heard read in this or any other Association; and so I fear that my contribution will appear very tame when placed in comparison with his. My paper in any event is simply a confirmation of what Mr. Nettleton has so fully established.

REGISTRY OF METERS.

Under the above title the writer read a short paper before the Ohio Gas Light Association, at its first meeting last month (September); and with the risk of repeating myself a little I shall give not only the records presented in that paper, but, in addition, furnish the result of tests made by Prof. Wormley, our State Gas Commissioner, on 2,122 old meters.

In the paper read to the Ohio Association I gave the results obtained in the testing of 2,200 meters as they came from the maker's shop, and before gas had been passed through them. Also results obtained in the testing of 282 old meters, mostly removed at request of consumers.

Of the new meters there were found to be 708, or 32.18 per cent., fast; 1,108, or 50.4 per cent. slow; about 17.4 per cent. being exact. But all of them (2,200) varied less than three per cent. from exact; and there were but few showing a variation from exactness of more than one per cent.

You will observe that of the meters not absolutely correct, nearly 50 per cent. were shown to be more slow than fast.

Of the 282 old meters tested by our company there were 107, or 38 per cent., fast; and 125, or 45 per cent., slow; 17 per cent. proving exact. Notice that nearly the same per cent. of old and new meters are exact—17 per cent. in one instance, as against 17.4 in the other. The slow meters averaged 3.25 per cent. slow; while the fast meters averaged 2.63 per cent. fast, or a general average of .44 of 1 per cent. slow.

From Wormley's register we calculated the following results: 720 meters, or 33.9 per cent., registered fast; 1,118 meters, or 52.7 per cent., registered slow. Please notice again the striking similarity of results obtained in the testing of 2,200 new meters by our company, and the testing of 2,122 old meters by

Prof. Wormley. Both the number and per cent. of meters registering fast and slow are almost identical in each register. Of the meters recorded fast in Wormley's register, 78.5 per cent. registered less than three per cent. fast, and were considered correct; 6.4 per cent. registered between 3 and 5 per cent. fast; 11.4 per cent. between 5 and 10 per cent. fast; 2.6 per cent. registered between 10 and 15 per cent. fast; 1.1 per cent. registered between 15 and 20 per cent. fast. Bear in mind that the percentages here named refer to the number of fast meters, and *not* to the total number tested. To reduce the figures here given to per cents. of the whole number tested, divide by 3.

Of the slow meters, 77.7 per cent. registered less than 3 per cent. slow; 7.7 per cent. between 3 and 5 per cent. slow; 12.1 per cent. between 5 and 10 per cent. slow; 2.1 per cent. between 10 and 15 per cent. slow; two-tenths of 1 per cent. registered between 15 and 20 per cent. slow. In this case to reduce the figures given to per cents. of the whole number, divide by two.

The fast meters (of the old lot tested by Wormley) averaged 2.82 per cent. fast; the slow meters averaged 2.7 per cent. slow.

Of this lot there were 266 meters, or 12.5 per cent., exact; and 18 meters, or less than 1 per cent., which failed to register. Excluding these 18 meters, the total number averages .47 of 1 per cent. slow.

These meters had been in use—many of them at least—for several years. Up to this time (1871) there had been no regular system of testing, and but few had been proved until the general test was made. It appears from the above figures that while there were special cases of injustice, yet, on the whole, the public were receiving all the gas they paid for, and the gas company was being paid for about all the gas it delivered to consumers.

Recently there were similar records presented to one of the English Gas Associations in which 28½ per cent. of the meters are reported fast, and 30.69 per cent. reported slow. From this we infer that about 41 per cent. were correct. The fast

meters averaged 4½ per cent. fast, and the slow meters 12.92 per cent. slow. From these figures we calculate that the whole lot averaged 2.74 per cent. slow.

Another English engineer reports the result of testing 10,500 meters about as follows: 48.77 per cent. correct; 25.5 per cent. fast, and 22.6 per cent. slow. The slow meters averaged 8.21 per cent. slow. The average per cent. of error in fast meters was not given; hence the general average of the whole lot cannot be calculated.

The per cent. of correct meters, in both of the English cases referred to, seems large; but they doubtless were correct only within the meaning of the law or custom, and not exact.

In presenting this paper to the Association, I do it with a view of getting the figures into a permanent record, rather than with any hope of specially interesting the members present.

On motion of Mr. Helme, a vote of thanks was tendered to Mr. McMillin.

DISCUSSION.

The joint discussion on the subject was then proceeded with as follows:

MR. J. C. PRATT—I want to say a few words on the subject treated of in these papers. The company (Jamaica Plain, Mass.) that I am connected with has been endeavoring for several years to educate its consumers up to the idea that the gas meter is an instrument as nearly perfect as is possible for human invention at the present time to make it; and that there are no bills presented to them over which they have so much careful guard against fraud as they have over their gas bills. We have instructed our men as they go around every month not only to take the state of the meters, but to hear any complaint from any customer, and then to carefully investigate the reasons advanced. We instruct them to spend just as much time as our consumers wish in giving a clear and perfect explanation of the operation of the meter, and to so instruct them in the method of ascertaining the amount of gas con-

sumed in order that whoever can read the time from the dial of a clock can read his gas bill from simply looking at the meter dial. We desire to satisfy them fully that there can be no fraud. We have accomplished a great deal in this way. Many of our customers can read the meters just as well as we can ourselves. A year ago last summer we undertook to carry out an entire inspection of our meters. That is, we inspected every meter which had been placed in position for more than one year. Although I have not got with me the details of that inspection, I may state that our method was a little different from the one described by Mr. Nettleton. Every morning we started out a couple of men, with instructions to remove the meters from a certain district. They would collect at one gathering a dozen, fifteen, or twenty, and bring them to the shop, where we have installed a perfect set of testing apparatus. Those that the test showed to be correct, or within a variation limit of about two per cent, were returned before nightfall of the same day to their former positions. Those proved by the tests to be either fast or slow were replaced by new ones. We continued this process from day to day, until the entire ground was gone over; and we pursued this course as much for the purpose of satisfying the people as to satisfy ourselves. We know that the meter is a prolific source of trouble, and is continually being blamed—indeed, is almost universally complained of by the consumer as a means for perpetrating fraud. We publish a printed annual report, doing that also as much for the benefit of our consumers and the people of our town as for the information of our stockholders. We distribute that report among the residents in order to show them just what we have been doing; how much money we have earned; how much our profit accounts foots up—in fact, we give them the identical information that we furnish to our stockholders. Among other things mentioned in our last annual report, we stated:

"During the last summer we have had a thorough and careful inspection of our meters. Every meter in use by the company, excepting those placed within the year, was taken out and submitted to a thorough test, the result of which is highly

gratifying to us, and should be to our consumers. A very few registered fast, and those only averaged three per cent.; while the general average of all our meters shows about two per cent. slow."

Those reports we give to the people in order to show them that we are not cheating them with our meters; and I may add the distribution of the reports has given very great satisfaction.

MR. R. J. MONKS—A few days ago I received a note from the Secretary of the Association inviting me to say a word or two upon this matter of meters. While in general terms I agree with what has been brought forward, and have been very glad to hear what has been said on the subject, yet, for the sake of argument, what little I may now mention will be in support of the ground that it is in the line of mistaken policy to take out all the meters of any company with a view to testing them once in three years. The principal objection which occurs to my mind is that we are engaged in a business in which there is a great deal of prejudice shown against us; and the people with whom we deal either think that the gas manager is not disposed to do them justice, or that, to put it mildly, our machinery or methods are not accurate. This is particularly true with regard to their ideas concerning the gas meter. A common old saying was, "He lies like a gas meter;" and a multitude of people in my own community (and from that I am led to presume they will be found in other communities) are in the habit of saying disrespectful things with regard to our meters. We claim that they are instruments which measure accurately; and I think the paper last read is a good demonstration of the truth of that fact. It certainly is proved, from Mr. McMillin's figures, that, after a period of from fifteen to seventeen years' use, a number of meters, corresponding almost exactly with the number of meters employed by my own company, were tested with the result that the inaccuracies were scarcely perceptible. If, after seventeen years' wear, a watch, upon careful testing, should be found to have run as accurately, it would indeed be a compliment to the skill of the watch-

maker. Now, should a manager of a large company decide at any one time to take out all the meters in use by such company, with the idea of having them inspected, the consumer may be very apt to put a bad interpretation upon the operation, more particularly so as he is apt to put a bad interpretation upon everything connected with the gas industry.

The first thing for us to do, so far as we are concerned, is to have an accurate meter inspector—who will make no mistakes in reading the dial; for we must hold an incorrect reading as an unpardonable sin. Our company (the South Boston Company) is one of the sub-companies of Boston. We have two meter inspectors attached to our company. I used to hear, among the better class of my customers a good deal of comment upon the meter. They would say they were satisfied that the men in charge of the company's affairs were honorable men, but were equally frank in asserting that they had no faith in the meter. I adopted a plan for convincing the people of the reliability of the meter as an accurate instrument for the measurement of gas, which has succeeded so well in effect that I think it might be adopted elsewhere to advantage. We had constructed for us a meter set in a plate-glass case, with a nickel plated frame just large enough to firmly hold the glass; the meter itself was nickel plated, and it had a plate-glass top. That meter was placed in front of the cashier's desk in the collection office, where everybody who came in to pay a gas bill could not help noticing it, and could see in every detail just what a meter was like. Sometimes, when I would meet a gentleman on the street who would speak to me about his gas bill, usually ending up with the intimation that the meter was an unreliable affair, I would ask him to step into the gas office. Connected with the meter, in the plate-glass frame, and close to it, there is situated a tube or bar (also plated) about 4 feet in length, and on this bar, in an upright position, are arranged gas heaters as well as burners. The meter is so placed as to show the action of the diaphragm, and the effect on it of using one or more burners. As the first move, I would start one light; the meter would commence to move, but the action would be so slow as to be hardly perceptible. Then I would

turn on three, four or five burners, and then of course the meter's action would be greatly accelerated, and immediately the dial would indicate the quantities of gas being consumed. This test would speedily satisfy the consumer witness that the meter *did* measure the gas, and convince him that it would register the amount consumed with *some* degree of accuracy. This is a device which I think some other gentlemen of the convention might well adopt to their advantage.

Before coming to this meeting I requested our Assistant Superintendent, Mr. Jones, to prepare a statement regarding the experience of our works in respect to this matter of meters. In compliance with this request he wrote me a letter, which, with your permission, I will now read:

"SOUTH BOSTON (MASS.) GAS WORKS, Oct. 11, 1884.

"R. J. MONKS, Esq., Treasurer:

"Dear Sir—During the five years from 1879 to 1883, inclusive, the South Boston Gas Light Company has caused to be removed and inspected by the State Inspector (an official appointed by the State) 57 meters, by request of the consumers of gas through these meters who believed them to register more gas than they really passed. Of these 57 meters, 30 were found to be fast, or against the consumer; 6 were shown to be slow, or against the company; 20 were found to register correctly; and one proved very irregular—at first failing to register at all, and afterward registering 18 per cent. fast.

"The extremes were 14½ per cent. fast and 13½ per cent. slow, without making any account of the one returned as irregular. Of these meters, 56 were made by Tufts Bros., and one by Thomas Glover, of London, England. The average of the fast was 7.08 per cent.; the average of the slow was 5.28 per cent.

"It has been the custom of this company, upon finding that a consumer's meter registered no gas after two or three months' inspection, to remove it and test it at the works to ascertain if it were stopped. Of course, these stopped meters are never tested by the State Inspector when removed, as consumers have never reported, nor called to see why they received no

bill—with one single exception—in eight years' experience. During the five years 65 meters were found to have stopped registering, the details being as follows:

"Year 1879.—Total meters stopped, 18; of which 8 were two-light, 7 were three-light, and 3 were five-light.

"Year 1880.—Total meters stopped, 15; of which 5 were two-light, 6 were three-light, 3 were five-light, and 1 was ten-light.

"Year 1881.—Total meters stopped, 6; of which 3 were three-light and 3 were five-light.

"Year 1882.—Total meters stopped, 7; of which 6 were three-light and 1 was thirty-light.

"Year 1883.—Total meters stopped, 19; of which 2 were two-light, 14 were three-light, 1 was five-light, and 2 were ten-light.

"If the 65 stopped meters tested were included with those found slow, and an average taken (calling each meter stopped 100 per cent. slow), the average slow will be 92.14 per cent.

"Our meters are principally of one firm's make (that of Tufts Brothers, known of late years as Nathaniel Tufts), but there are a few two and three-light meters made by Thomas Glover, of London, England, and possibly a dozen made by the American Meter Company; so that the foregoing cannot be taken as criterion of the merit of one kind of meter.

"The law in Massachusetts regarding the inspection of meters allows 2 per cent. fast or slow; so that a meter registering either way within the two per cent. limit would be considered correct. Eight of the 30 meters found fast were but 2½ per cent. against the consumer. Very respectfully,

"EDWARD C. JONES."

I will repeat in conclusion, what I said at the commencement. It seems to me, in view of the last paper which has been read here, that if, for the period covering the lengthy time specified, a test of over 2,000 meters has shown that they were substantially correct, it is a good demonstration of the fact that the gas meter is more accurate than the average watch; and I again repeat that to take out all the meters at

any one time will tend to create suspicion among consumers that we believe the instruments are inaccurate. Taking this view of the matter, would it not be better policy to make the tests from time to time whenever the superintendent, or some-one else posted in regard to their working, thinks that inaccuracies exist, rather than have them all tested at once?

MR. EUGENE VANDERPOOL—I want to add a word to what the gentleman has said. There is one question which does not seem to have been discussed. Suppose, for instance, a consumer comes into the office and complains about his gas bill or about his meter; and then afterwards an investigation and test of the meter proves it to have been 10, or even 15 per cent. fast. Unless you have kept a record of the meters, how will you arrange that bill with your customer? How far back are you going in the effort to make an equitable correction? We found that trouble; and so we introduced the system of periodical testing. We have followed it for nine years; and our present practice is to make a test of every meter at least once in three years. I was very much impressed with the paper of Mr. McMillin in reference to the coincidence in the percentages of meters—how nearly they ran together. We have tested a great many thousand meters, and I find that our record for the last six years shows that of all the meters taken out, 79.56 per cent. were found correct, or within the two per cent. which the law calls for. The variation of all the meters tested shows .14 of one per cent. slow; this fractional result covering tests of many thousand meters. When we first started the tests we found that the average was 59.25 per cent. correct, and that the percentage slow, or against the company, was greater than it is now. But the difficulty which I have suggested arises in respect to the settlement of bills. In Louisville, Ky., they had a difficulty of this kind. The consumer made a complaint, and the matter was taken into court. It was a very long time before the case was settled, and the settlement was a very expensive matter.

MR. MCMILLIN—With us, if a meter was found to register 5 per cent. fast, we searched back to determine the period when it was known to be correct—either at the time it was set,

or at the time when it was tested. We solder to the meter a brass tablet bearing date of the test. In the situation spoken of by Mr. Vanderpool we refer back to that date, calculate 5 per cent. for six months on the gas bill, and strike a general average. If the meter is slow we pocket the loss.

Mr. T. D Gilbert—While we are on the subject of gas meters I would like to ask if anyone of the gentlemen present has ever had any experience with the itinerant meter tester; I have had some experience myself on that score, and when I found that such a party was going the rounds of our city, I immediately went to him, telling him that I should not put any obstacles in his way, but that I wanted him to report to me every night the result of his observations. He promised to do so. As I heard nothing more from him for a while, I concluded that he had abandoned the business. But shortly there appeared in one of our daily papers a notice that such a man's meter registered 15 per cent. fast, as had been determined by "an expert meter tester" who was in the city prosecuting his researches. Of course, then the trouble commenced. I immediately followed in the wake of his operations, removed the meters to our works, tested them, and found that in every case (without a single exception) the matter was magnified. It was plain enough to see what the "expert's" object was in having his story published. I found in some cases that the meters proved by the "expert" were a little slow; but those particular consumers had not made any fuss over the fact. Taking it all in all, we had quite a lively time with them for perhaps a month; and the upshot of the affair was this: whenever anybody came into the office with the purpose of advancing the opinion that his meter was fast, we would say to him. "If you will go with us now, or at any hour you may name, we will take your meter down to the works and test it in your presence. We will not have it done in any other way. We will test it only in your presence. The process is perfectly simple; any child can understand it." While we have had a very few cases where people are willing to put themselves to that trouble, we found that the great majority of them had greater faith in the meters than they professed to have when first they came to complain

about them. Since we have adopted this course, and have followed the plan of fully instructing our consumers in regard to reading their own meters, furnishing them with cards containing full instructions about it, we have had very little trouble. If any one here has had any experience with such itinerants, I would like to know how he has dealt with them, as I think very likely they may be roaming around the country again this winter. If there is any method of dealing with them effecttually I would like to know it.

MR. W. H. PEARSON—It is of prime importance in such cases that every gas company should have a duly constituted authority to which appeal may be made. It is of interest to every gas company that there should be a proper and equitable government inspection act. It would certainly get over the difficulty which our friend Gilbert has had to contend with. I am quite satisfied that the consumers possess a little more faith in gas meters than they profess to have. Before the Government Inspection Act was passed in the Dominion of Canada (and then it cost the consumer nothing for having a test made) we had a great many more people who desired to have their meters tested ; but when the act became operative, in the event of their having to pay for the testing if the meter was found correct, they began to think the meter was not quite so far wrong as they had supposed it was. I am quite satisfied it is to the interest of all gas companies to court investigation as far as possible ; and that in this respect it is a very important matter there should be a government inspection. With regard to the percentages of slow and fast meters as shown by the tables which have been presented, I wish to say that I have been struck with the very great similarity between those tests and the tests that have been made in Toronto, during a period of six or seven years, since the Government Inspection Act clauses were inaugurated. With us as a rule (just as we heard it stated here) the percentages are somewhat against the gas companies. Now as to whether or not (considering the money expended) it pays a gas company to have such test made ; speaking for myself, I may say I am of the opinion that the practice does pay. The annual cost to our company for test-

ing meters (we have about six thousand consumers) is about $1,200, and I am satisfied that this money is well spent, if for no other reason than because of the increased amount of confidence in his meter which the consumer appears to have. It is not a high sum for a large company to pay. The company may not entirely recoup itself in the money outlay; yet, if we come to calculate the matter closely, I am not so sure but that the annual expenditure may possibly be offset by the additional amount of gas registered—arriving at this idea from a knowledge of the fact that the average of tests always appears to show a certain general percentage of registration against the company. Be that as it may, the great compensating advantage to a company undoubtedly appears to lie in the increased amount of confidence which a Government inspection inspires in the consumer. It is my positive belief that the members of the Association residing in States where no Governmental regulation exists would find decided benefit (instead of opposing such measures) in doing all that would lie in their power to have such Acts become law.

MR. LITTLEHALES—There is another point I would like to refer to, and that is the necessity of trying to satisfy consumers who come to our office to complain of their gas bills. There occurs to my mind the instance of one gentleman who may justly be set down as a chronic grumbler. On a certain occasion he was particularly positive that his gas bill was too large. We said to him: "Let it go for a few days, and we will try to find out what the trouble is." We then had his meter read every day for a week, so as to ascertain as nearly as possible what the daily ratio of consumption was. At the end of the week I went to him with the figures and showed him that the average of the experimental week's consumption just exactly tallied with what he had been charged by the quarter. One day he had burned two hundred feet; another day seventy-five feet; and on a third day the consumption was only twenty-five feet. I said to him: "Your consumption appears to have been quite irregular last week, as on a certain date you only burned twenty-five feet." He asked: "What day was that?" I replied, mentioning the particular date. He ex-

claimed : "Oh ! I was out that night." During the twenty-four hours when the consumption had been 200 feet he admitted that there had been an entertainment at his house. Our record of the week's reading proved to him in a practical way that his meter was reliable. Just the nights when he was away from home, and when he had only a hall light burning, the consumption was shown to have been the least; but on the night when he had the entertainment the meter reading vouched for the increased use of gas. The state of the case was quite plain, and at the close of the conversation our erstwhile irate customer gracefully said he was sorry we had taken so much trouble over the case, closing with the statement that he had no doubt the bill was all right. I merely mention this incident to illustrate the necessity of doing our very best—of sparing no trouble, however much of time it may take—to give our consumers satisfaction. Another case occurs to me. A gentleman, now one of our judges, complained that a certain gas bill was very large. He wrote us a letter in regard to it, saying that he wanted to pay what was right, but claiming this bill was so extortionate that he would not pay it unless the company would sue him. I allowed a day or so to elapse, then wrote to him that the company only wanted to charge him what was right, adding if he would come down to the works and see his meter tested I thought he would be satisfied. So, he fixed a day when he said he would do as suggested. We had his meter removed and brought to the office—it had been doing duty for ten years at his house, but, even after that interval, no new meter could have possibly worked better. I tested the meter in his presence, explaining the operation to him so that he thoroughly understood it. He said he would go home and draw a check for the bill ; and he never complained to us after that. I think it a decidedly profitable policy that companies should spare no trouble in their attempts to give consumers entire satisfaction.

Mr. Helme—Mr. Nettleton suggests that a good deal of trouble arises from the want of knowledge on the part of the public with regard to the meter. I have no doubt a great deal of trouble does so arise. The University of Pennsylvania, a

year or two ago, did what I think was a good thing in installing as a part of their mechanical department a set of apparatus designed to afford instruction to the students in the matter of gas measurement. If you gentlemen, who represent almost all sections of the country, could induce the managers of colleges and universities in your neighborhoods to follow that same practice it would, in a few years, afford the gas fraternity no inconsiderable relief. You yourselves know, and we all have ample confirmation in the facts presented in the papers of Messrs. Nettleton and McMillin, that the meters are not, on an average, far from correct; and also that whatever average variation does occur is really against the company, and consequently in favor of the consumer. I am told Dr. Ford testifies that the average of meters varying from correct, in the case of the Washington Gas Light Company, is against the company. If the universities and colleges throughout the country would follow the course practiced by the University of Pennsylvania, and make these subjects form a part of the daily instruction of the students, we would be helped thereby very much indeed.

MR. LITTLEHALES--The remarks of Mr. Helme recall to my mind an incident which occurred to us a few years ago. Another of the chronic grumbling class called at our office and claimed that we had been charging him for three or four times the quantity of gas consumed by him. He repeated the familiar complaint that his neighbor was burning four times as much as he, but was only being charged one-quarter as much. This happened at about the middle of a month. I told him I would look into it. That day I directed that the meters supplying the two houses should be changed; and consequently we had at the end of thirty days one-half month's consumption of each party. The result of the experiment can readily be imagined. The chronic grumbler who thought he had a fast meter, found that his neighbor's meter was equally fast; and that with what he had believed a slow meter he had burned an equally large amount of gas. We have had no trouble with him since.

THE PRESIDENT—If there are no further remarks to be

made on this subject, we will proceed to a consideration of some of the pressing routine business of the Association.

President Stedman announced the following

COMMITTEE OF ARRANGEMENTS TO MANAGE AFFAIRS OF NEXT ANNUAL MEETING:

Messrs. A. Hickenlooper, John Fullager, and J. Anderson, of Cincinnati, Ohio; Emerson McMillin, of Columbus, Ohio; and H. J. Reinmund, of Lancaster, Ohio, and the Secretary.

DECEASED MEMBERS.

The President next called attention to the fact that the painful duty devolved upon him of announcing to the Association the death, during the year, of two members, namely, Mr. W. G. Cartwright, of Hoboken, N. J., and Mr. M. H. Jones, of Easton, Pa. Continuing his reference to the matter, the Chairman said:

It is fitting that proper recognition of their memories be made by their fellow-members, and that such recognition be spread upon the minutes of the Association. The previous course pursued under similarly sad circumstances was to request the President and Secretary to prepare suitable obituary notices and have the same incorporated in the printed volume of the Transactions. As a volume of the proceedings will be published this year, I would suggest that a committee of two be appointed—care being taken to appoint thereon gentlemen who were familiarly acquainted with the deceased members—with instructions to follow the course established by precedent with regard to these matters.

Mr. S. G. Stiness moved that the usual policy of the Association be followed. The motion was adopted.

AN INVITATION TO VISIT THE WHITE HOUSE.

The President called upon Secretary Humphreys to read the following communication, which had been forwarded to the Association from the White House:

EXECUTIVE MANSION, WASHINGTON, D. C.,
October 16, 1884.

Dear Sir—It gives me pleasure to inform you that the President will receive the members of the American Gas Light Association, with the ladies who accompany them, at a quarter past two o'clock to-day.

A previous engagement precludes naming an earlier hour.

Very respectfully,
O. L. PRUDEN, Sec'y.

WILLIAM A. STEDMAN, Esq., Willard's Hotel.

MR. STINESS—I move you, sir, that we accept the courteous invitation of President Arthur, and that we pay our respects to him this afternoon at the time named. An attempt was made to have the reception hour fixed at one o'clock, but a previous engagement of the President prevented such an arrangement. In a conversation held this morning with Mr. Pruden (President Arthur's private secretary), it was stated by the gentleman that the time occupied at the Executive Mansion by the members of the Association need not exceed ten or fifteen minutes. In view of this, it will therefore not become necessary to make any serious inroad upon the time which has been allotted for our session of this afternoon. I think, sir, it is nothing more than proper to one who has so manfully and creditably borne the mantle thrust upon him, that the American Association of Gas Engineers, coming as they do from all parts of the United States, should take this opportunity to pay their respects to him, not only as a gentleman, but also to him as the honored head of our nation.

Mr. Helme seconded the motion.

MR. M. S. GREENOUGH—I would like to inquire what the intention of the Executive Committee is. Are we to leave the hotel in a body at two o'clock, or are we to meet at the White House at a quarter past two?

MR. STINESS—The Executive Committee decided we were to meet here. It was stated to the Committee, by the Private Secretary of the President, that at the White House two o'clock meant just two o'clock. In conversation with Mr. Helme, of

the Committee of Arrangements (who was much pressed with business and asked me to attend to these details), it was arranged that we should leave here shortly before two o'clock, so as to reach the White House at the hour named in the invitation. Mr. Pruden explained that the President would enter the reception room at exactly a quarter past two. It was thought proper the Association should visit the Executive Mansion in a body, as they deemed that course the more becoming way of paying their respects to the President.

The motion to accept the invitation was unanimously adopted.

THE RECEPTION.

When the appointed time had arrived the members of the Association, escorting the lady visitors, and a few invited guests—the total delegation numbering about 250—assembled in the parlor of Willard's Hotel, and from thence proceeded to the White House. Arriving at the Executive Mansion, the visitors were conducted by Secretary Pruden to the "East Room," and were subsequently shown into the "Blue Room," where their formal presentation to President Arthur was made. The distinguished and affable gentleman received the delegates with his wonted courtesy, and not a single hitch marred the progress of the ceremony.

SECOND DAY—AFTERNOON SESSION.

The Association was called to order at 3 o'clock.

REPORT OF COMMITTEE ON PRESIDENT'S ADDRESS.

THE PRESIDENT—The Committee on President's Address have presented a report, which the Secretary will please read. Secretary Humphreys then read the following:

"Gentlemen—Your Committee, to whom we referred the address of our President, would most respectfully report that the time before the close of this meeting does not admit of that careful consideration of the topics (so forcibly expressed by him) that their importance demands.

"Your Committee would, however, recall for your consideration, and recommend that some action be taken by the Society at this meeting, on the subject of combating the organized raiders an the gas interests—who are now so active throughout the country.

"Your Committee also recommend that seven hundred copies of the address be printed for the use of the members.

F. C. SHERMAN,
W. H. DENNISTON, } Committee."
D. D. FLEMMING,

THE PRESIDENT—If there be no objection the report will be received.

A communication from Mr. A. L. Allen, of Poughkeepsie, N. Y., was read, and laid upon the table.

THE PRESIDENT—We have a paper contributed by Mr. R. B. Taber, of New Bedford, Mass.; but unfortunately a case of severe illness in his family prevented the attendance of the gentleman at our sessions. The paper awaits your decision as to whether or not it shall be read.

On motion of Capt. W. H. White the paper was received, and Secretary Humphreys was instructed to read it to the Association. The Secretary therefore read the communication (forwarded by Mr. R. B. Taber, of the New Bedford (Mass.) Gas Light Company), which was entitled—

GAS STOVES A MEANS OF REVENUE.

Gas stoves represent, I think, a species (in naturalist's phrase) of which the whole question of the application of the heating power of gas to domestic and mechanical labor is the genus; and I confess myself a poor student who hopes much and knows little of the extent of that genus. But the study is every day becoming more interesting since the additional impetus given by the constant discovery of natural gas in the gas wells of Pennsylvania, and the heating gas operators are developing every day a field which is the legitimate and direct work of the gas companies. Truly, we do not fully occupy our ground

in the matter of illumination ; the limit of saturation—the point at which the consumer has all the light he wants in the place he wants it, and is fairly satisfied—is nowhere attained, in New England, at least ; but I take the hint from the heating company, and am bold to nail my Thesis on the church door of this Association, viz : A gas company shall be able to contract to light a hotel, cook its dinners, run its elevator, and heat its halls, as cheaply as can be done by any one else, and further, do all this more satisfactorily than any other agent, and I will defend my proposition.

The demonstration afforded in the series of the South Foreland lighthouse experiments, that gas has its "unco grip" on the heat end of the solar spectrum, from whence neither oil nor electricity can drive it, might be laid as a foundation for the theory of the heating power in the new study of thermal dynamics. The lately published facts concerning the conservation of heat force as expended in an Otto gas engine gives further encouragement ; and the German experiments in the relative caloric effects of different gases drives the gas manager to his benches with a grim smile.

One thing developed the past few years is noticeable. Gas men learned from the steel trade how to apply heat ; and the Siemens burner is as great a success, *per ipse*, as the steel ingot. Mr. Fletcher, of Warrington, has applied to his laboratory apparatus a heated blast of air and gas. It is possible that in that torrid climate of 2,300°, in which gas first develops, we shall find the first fruitage ; that the greatest calorific power and most powerful illumination will be obtained by keeping this intense temperature, or as near this as practicable, at the point of ignition ?

Turning now from the genus to the species—the application of gas as heat to domestic uses in the cooking and heating stoves—much that is satisfactory has been accomplished.

Since the gas companies turned their attention to this subject the small, two-ringed boiling stoves, often apparently contrived to emit the worst possible odor, have been withdrawn to give way to the self-supporting ranges—"kitcheners"—set up with iron connecting pipe—no longer summer residents merely,

but veritable sojourners in the land. Experience has taught also the New Bedford Company to make all bills for the rental of heating stoves to expire May first of the following year; and to so place the stoves in the kitchens that they may remain all winter to further this object of making the gas stove a fixity. I would not, of course, imply there is no use for these smaller stoves, so serviceable in the nursery and for other small work. I simply call attention to the fact that there is a good call for gas for cooking in winter as well as in summer, and the knowledge that has been gained in practice can be thus formulated. Make your stoves serviceable all the year round.

It is not, in my opinion, a vexed or debatable point, "Can we afford to *rent* the stoves?" I dare propose, to those who cannot see enough profit in renting them, the other alternative, "give them away;" and in this proposition do not forget that they cost enough—indeed, the gas industry is handicapped by the stupendous price of these ungainly erections. True, we now have nickel trimmings free, and, now and then, steatite burners; still, oh, monstrous! "But one half penny worth of bread to this intolerable deal of sack."

Would that our friends the gas meter and stove companies would make their wares handsomer and their prices lower, following the example of our gas companies which reduce the price and raise the candle power at the same time.

This much might be said for the system of rental; it brings the stove within reach of all, thereby directly attaining the object sought—increased day consumption. I think a fair rental to cover depreciation, care and labor, may be made to cover all the "outs" of this system.

The theoretical question of what kind of burner is best, really, is of little practical importance. An essay on this subject would be more fitting to such a body as this than to the occupant of the kitchen. It is possibly certain that the open flame burner under the oven is as available and powerful as any other form. Recent experiments, published in the English *Journal of Gas Lighting*, tend in that direction; but, as to my own judgment in this matter, practice must decide, although it is universally admitted the open flame has none of the draw-

backs of the atmospheric burner at the period of first ignition, and this settles that point. For the ringed burners on the top of stoves, the green fires of the Fletcher type, as developed by the Buffalo Dental Company, are specimens of the finest combustion.

Economically the character of the burner is of no importance. All stove makers now manufacture their goods to burn about the same quantity of gas per hour at the same pressure; but more depends by far on the character of the person in whose hands the burner is placed than the kind of burner used; and everything depends on its simplicity and freedom from noise, as also from foul odors.

A gas heater is more profitable even than the cook stove as regards gas consumption; but the attendant circumstances are different. The consumption will perhaps average 50 per cent. more with the latter than the former; but this supply will be taken from mains not now lying idle; and since they are used in closed rooms, flues should be provided for the exit of waste products of combustion. The gas log is simply insufferable without a chimney attachment; the different forms of atmospheric burners are dangerous in tightly closed rooms, and the combustion of air in the open flame arrangement is decidedly deleterious. An experiment was tried with a "Verity fire" in an open grate without flue, which, after the first ten minutes every morning, worked well and without any perceptible odor: but with a flue, and the addition of being well set up, there is no cheerier fire, nor one so easily attended to, or so prompt in its action. I think for closed stoves the flameless fire will ultimately prove the most efficient. The idea is as yet hardly developed by gas stove makers.

After all, to sum up, what is the advantage of the gas stove speculation? Does it pay? As an outside branch of the business it might be said it draws customers, promotes good will, and indirectly prompts the consumer to find other uses for your product, thus accustoming him to the use of gas. If it served no other object, this last would be a great inducement in itself, and would offset the incurring of much care and inconvenience. The other liabilities—interest, depreciation,

pipe, labor, etc.—are like unto your service and meter in disguise, not a direct source of revenue, not intended to be (but really, practically) paid for by the rental.

The stove business, kept as a separate account, relieved by the credit of rentals, at the end of four years stands, say, at $4,000—this outlay including the cost of many patterns of useless stoves—which dead accumulation can only be charged to that familiar source, "the pursuit of knowledge." On this capital the depreciation is 10 per cent.—$400; labor in setting stoves and cost of pipe for present year, $200; total, $600. The rentals for the present year on 300 stoves, including heaters, will be $750, returning, therefore, an interest sum of 4 per cent. on the account. In the same time, however, the day consumption has increased step by step, until it now is three millions feet a year in excess of the ante-stove age, while in all that period not an extra laborer nor a single extra bench has been called in to aid the manufacturing department in making the few thousands feet of output required daily to supply this increased sale.

A heating gas company's engineer lately informed me he had sold 160,000 cubic feet of gas a day in this branch of our business—employing gas for its calorific uses only. There is surely encouragement, then, for that new race of mortals who shall take the gas so learnedly and wisely made by the gentlemen of this Association, and dispose of it in the infinite variety of ways to which it may be applied.

On motion of Mr. H. B. Leach, the thanks of the Association were extended to the author.

DISCUSSION.

Mr. J. P. Harbison—There are some statements in the paper presented by Mr. Taber with which my experience does not permit me to agree. I do not agree with him in that the proper way of attending to this business is solved by the rental system. I am totally opposed to that plan of procedure. I believe if gas companies generally should go into that style of business they would regret it exceedingly. They would be forced to employ a number of men to look after their wares,

because the people who take the stoves, paying only a small rent for them, would feel no sort of responsibility with regard to the condition in which they were kept; and the gas companies would find, as a rule, that the stoves (being made, as they are, of sheet iron) would very seriously depreciate in value if not properly cared for—they would not receive the same share of attention that would be bestowed upon them if the persons employing them had bought them outright. Every housekeeper desires to manipulate matters in her kitchen for herself, and, naturally enough, objects to being dictated to or directed in her domestic affairs by an officer or employee of the gas company. I think such would be the general experience throughout the country. I believe we would be making ourselves a good deal of trouble were we to go into a house and suggest to the lady that she direct her kitchen maid to keep the gas stove clean, to polish it up, to take strict care of the burners, and all that sort of thing, finishing the list of instructions by insisting that all these methods must be pursued with great regularity. Now, on the other hand, if a stove is purchased outright, and is then worn out or destroyed through the owner's neglect, why, the loss falls upon the owner, and the cost of this matter then ceases to be an expense, *per se*, to the gas company. In our city of Hartford we have had no trouble in the matter of selling the stoves; and we also note that those who are desirous of introducing gas stoves into their houses do not hesitate very long at the price. The Hartford Company, being practically, as the gas brethren all know, a benevolent institution, we do not ask any profit on the stoves we sell. We obtain the largest rate of discount which we can induce the stove manufacturers to grant us; and we give the party who purchases one of them the full benefit of that discount, simply adding the freight to first cost of stove. We also charge a customer the actual cost of connecting material used, also charging the value of time actually spent in doing the work. We do not give away anything. We make a profit on the gas that we sell, but none whatever on the appliances for consuming it. We have had very good success, and have now at work between six and seven hundred stoves in our little town.

The number is continually increasing; and we have yet to find a single case where the users have not obtained entire and perfect satisfaction. Further than this, we have had no complaints regarding the amount of gas consumed. It is not in every case possibile that the first attempts to use the stove meet with full success; but it is our practice to send an expert to give fullest instructions as to their manner of operation. The expert's duty is to show in a practical manner that any and every sort of cooking can be done and well done; in fact, that every cooking operation may be performed more satisfactorily, at much less expense, and with far greater comfort, on the gas cooker than with a coal heated range. If gas managers generally should give their close attention to this business, they would undoubtedly find their annual consumption greatly increased. Such has been my experience; and further, as you reduce the selling rates from time to time, you will note the consumption will increase in still greater ratio in this direction As has been well said in the paper, this consumption, aside from the raw material and cost of purification, practically costs the gas company nothing, and would require no additional meter (which is a crumb of comfort to the meter manufacturers), and would exact no additional clerical force to make out the bills, for the gas consumed in the cookers would all go into the consumer's lighting account. We find that the plan works well, and is especially desirable of development since the extra demand made upon us may be furnished at that period of the 24 hours when our mains are not driven to supply gas for illuminating purposes. It is a most profitable sort of consumption to us in Hartford, and I have no doubt that it is just as profitable to others who are working in a similar way.

MR. PRATT—What is the price charged by you for gas supplied to stoves?

MR. HARBISON—At the present time the price of gas in our city is $1.80; after the 1st day of December it will be but $1.60 —such course having been agreed to by a vote of our directors taken on Monday of this week. (Applause.) In further reply to the question as to what we charge for gas supplied to stoves,

I will say that we make no distinction. The gas passes through the same meter as does the gas supplied for purposes of illumination; and we are no respecter of persons in our business. The price is the same to everybody, no matter whether he burns 100 feet of gas in a month or whether his consumption reaches to 100,000 feet in the same space of time. The price in the past has been the same to all, and will be so in the future.

MR. W. H. PEARSON—My experience differs from that of Mr. Harbison in regard to the renting of gas stoves. Of course, being over in Canada, we are differently circumstanced from the position held by you in the States. We have no manufacturers there who will take hold of the business exclusively; and in Toronto we are under the necessity of manufacturing our own gas stoves, or at least a considerable portion of them. We have found, in our attempt to introduce gas stoves, that it is impossible, in the first instance, to sell them outright. Having had no experience in the use of gas cookers, the people are not willing to spend $25 (or more) in their purchase until they know something about them. We were at first, therefore, under the absolute necessity of leasing or renting them, and are obliged to do so even at the present time, in order that the people may become fully aware of their value. My plan has been to charge a sufficiently high rent for a stove to make it desirable for the parties to purchase it at the end of four or five months. I find that people after having a gas stove in use for four or five months, and becoming satisfied with it (as happens in almost every instance), they will purchase it; and such has been the case more largely this year than ever before. This may partly have occurred in consequence of the fact that on a certain kind of gas stove we decided to charge an increased rent. People are willing to spend four or five dollars in the way of rental when they are not willing to spend a much larger sum in the purchase of a stove. Our experience may differ hereafter, when the people are more fully alive to the advantages and benefits to be derived from cooking by gas. The paper suggests, if I recollect

rightly, that, on the whole, the open flame burner was found to be more economical than the atmospheric burner. Just before leaving home I had some tests made with the different burners. I could not make them personally, as I was so much pressed for time; but I have every confidence in the person who carried them out and reported the results. The only sort of stove used in the tests was of the description furnished by the Goodwin Company, and I should be very glad if some one connected with that establishment would furnish an explanation that would account for the different cooking results obtained when employing the different classes of burners. The stove may be heated by two methods, being fitted with both an atmospheric and an open flame burner. There may possibly have been something wrong about the tests; but if so I cannot trace that something out. The results were as follows: With the atmospheric burner we cooked 6½ pounds of beef in a period of one hour and forty minutes, and a total consumption of 24.9 feet of gas; with the open flame burner the same quantity of beef took three hours and twenty minutes time in its cooking, and a consumption of 42.7 feet of gas. I recently made a test on a stove that is sold in Montreal; operated with an atmospheric burner, it baked 6¼ pounds of beef in one hour and forty-five minutes, the duty being accomplished with a consumption of 24.9 feet of gas, or just the same as accomplished in the case of the Goodwin stove. With the stove manufactured by ourselves, and operated with an atmospheric burner, we cooked 6¼ pounds of beef in one hour and forty minutes, and with a consumption of 22 cubic feet of gas. In the Montreal stove, fitted with an open flame burner, we baked two loaves of bread, weighing 1½ pounds each, in 55 minutes, the gas consumption being 17.1 cubic feet; with our own stove, heating conditions being identical, the same duty was accomplished in forty-five minutes, with a gas consumption of only 14 cubic feet. In each case, so far as I could ascertain, the bread was baked equally well, and the beef was cooked (as nearly as we could judge) to exactly the same degree. I have often heard that the open flame burner was the more economical, but my own experience

does not tend in that direction. I find that the open flame burners, and particularly those right under the oven, gradually get partially choked up. Perhaps this may be accounted for by the large percentage of carbon contained in the water gas manufactured by us, and that such stoppage is not experienced by those supplying coal gas. Taking it altogether, my experience has been decidedly in favor of the Bunsen burner. With regard to the better introduction of gas stoves, I may state that we have found it advantageous to sell the gas consumed in them at a somewhat lower rate than is charged for that supplied for illumination. We are now selling gas for cooking and heating purposes, and also for gas engines, at $1.25 per thousand feet; our regular price for illuminating purposes to our smallest consumers being $1.60, and to consumers of over 200,000 feet monthly, $1.25. Here, again, we differ a little from friend Harbison. The result of reducing the price and introducing the stoves has been very largely to increase our consumption for this purpose. We sent out 200 gas cookers this season. I estimate that our consumption for purposes other than illumination amounts to 12,000,000 cubic feet per annum, and it continues rapidly to increase.

MR. H. B. LEACH—Our experience has been very similar to that of Mr. Pearson. I am very glad that our friend Harbison has got a class of consumers who are willing to purchase the stoves ; but in our little village I speedily found it would be impossible to introduce them in that manner, although I tried very hard to accomplish it. Having determined to introduce them at any rate, I found the only successful means of doing so was by renting them. I have been very successful in the endeavor, and feel perfectly satisfied with the result.

MR. T. LITTLEHALES—My own experience differs somewhat from that of Mr. Pearson. I would almost feel more disposed to give the stoves away than to lease them. We at first tried the leasing policy, and we found that when we had them returned to us the sheet iron would be half rusted through, and they would be covered with grease ; in short, it would take a man three-quarters of a day to clean one of them. When we would send the refurbished stove out again, the lady of the

house would say: "I don't want a second-hand stove; I want a new one." Then, again, when we charged anything like a reasonable rent, they would say: "What is the cost of this stove?" I would name the price (our rental rate was rather a large percentage on the cost), and the answer would be: "You are a modest man to ask such a large rate of interest on your money." Oftentimes they would buy the stove rather than pay what they thought a high rent. We found this style of complaint somewhat of a drawback to the leasing system. We appear now to have found a plan which will work very satisfactorily. When a person wants a gas stove we will say to him that it will do such and such things; that we are willing to put it up in his house, and make the connections; then if it does not do what we say it will we will remove it without cost to him. If, on a trial, it is found to do what we said it would, then we ask him to pay for it. I dislike the leasing plan very much. I believe that the trouble, annoyance and loss by the leasing practice more than counterbalances the advantage in increased send-out.

MR. LEACH—I omitted to say that the parties are obliged to take the same stove the next year if they wish to rent; but if they wish then to purchase we sell them a new stove.

MR. G. D. CABOT—It seems to me that the matter of renting the stoves is one to be determined very much by the locality. Some of the gas people in towns near to our city rent their stoves, and I know that some of the stoves have been returned in very bad condition. My plan has been quite similar to that of Mr. Harbison—to sell the stoves at cost price. If a person makes any objection to immediate purchase, we put in a stove and let him use it for ten days or a fortnight, and then if he does not like it we will take it out. We have about one hundred stoves now in use, and have never been called upon to take back a single one. It seems to me that the matter of renting is one of those things to be decided upon by the local agent.

MR. HARBISON—Perhaps it is due to myself to state to the Association just what has been our course in our dealing with

the people in regard to this matter. You will remember that, some years ago, a member of this Association was requested to furnish the Association with some statistics showing comparisons between cooking done upon gas stoves and that upon coal ranges ; also statistics regarding the cost of fuel, and with respect to the results in weight of meats cooked, the percentage of loss, etc. I succeeded in obtaining a large number of copies of that table of statistics, and I have had them very generally distributed amongst our consumers. We have not hesitated to stake our reputation on the correctness of those statements. We have assured the people, on the strength of those statistics (knowing that the author was ready to back up any assertions that might be made which were not any greater than he had put forth), that there would be so great a saving in the weight of meat cooked on the gas stove, as compared with that cooked on the coal range, as to pay for the cost of the fuel used ; so that really, in point of fact, it did not cost the householder a farthing for gaseous fuel for cooking purposes. When a man can boldly and unreservedly make that statement and be prepared to back it up with figures, there is no difficulty in selling stoves at cost rather than renting them. It at once takes away all objection to immediate and outright purchase. We can assure them that it will not cost anything for fuel, that the cooking will be better done, and that it will be pleasanter and more convenient to them every way than was the old practice. I first demonstrated the accuracy of the statistics to my own satisfaction, by placing a cooker in the kitchen of my own residence, and making thereon a series of careful tests. The tests were convincing, and so I placed myself in the position to say to my consumers that the printed tables were accurately truthful. We have found our people ready to believe what we say with regard to it, and find them so now, too. I will say, further, that I do not know of a single case, since we commenced selling gas stoves, where a party has declined to own merely because it cost him something to do it. Every party who expressed a wish for a cooking stove has bought it and paid for it, and no one has declined to take a stove because we would not rent it to him.

Mr. Pearson—I may say that in Toronto I have done everything that Mr. Harbison has stated—possibly a little more. Every gas bill has printed upon its face, in such a place that everyone who reads it must notice it, a brief statement of the various advantages of gas cookers as compared with coal ranges. In addition to that, every gas consumer has more than once had circulars sent to him containing information with regard to the comparative amount of loss sustained by various articles of food during the process of cooking; yet notwithstanding that, we have not been able (or not until very recently) to get the people in our city to purchase gas stoves. I might mention another matter connected with the gas stove business, and that is with reference to the attempt to introduce the use of gas stoves throughout the whole of the year. The principal objection made by my people to keeping them up all the year has been that, with the ordinary gas stove, they cannot heat water for their baths. I might mention that our street foreman, Mr. Laxton, has, after a good deal of experimenting, introduced a system of burners into an ordinary cooking stove; that cooking stove will cook by gas as well as any gas stove that I have ever seen, and the cost of introducing the pipes is only some seven or eight dollars. Underneath the water heater in this stove are placed a couple of Bunsen burners; and they will sufficiently heat water for the bath. A patent has recently been obtained for it, covering the United States as well as Canada; and members of the Association will soon hear more about it. I am satisfied it is going to fill a gap which we have felt to be a wide one for many years past.

Mr. T. D. Gilbert—If there is anything connected with the gas business that I may claim to be conversant with it is perhaps this very question of gas stoves. The discussion we have listened to all goes to show that if gas managers will in some way bring good gas stoves before their communities they can get good returns from them. One man may have better luck in renting, another may have better luck in selling, and yet another may find it to his interest to give them away. But that is not the point. The real question is, "Can we get

the people generally to use them?" My own experience corresponds with that of Mr. Harbison. I first put a gas stove in my own house and satisfied myself that it was a good thing. Then the neighbors began talking about it. I got some of the more experimental of the residents to make a trial of them; I told them to bring the stoves back if they did not like them. By and by one after another began to employ them, and everybody liked them. At the beginning of the new year they did not go fast enough to suit us; so we took 20 per cent. discount right off from the manufacturer's prices, and thought it was a good investment. To show that it was we got our money back in three months on every one of them so sold. This all goes to show that there are a hundred ways in which we can get these stoves before the people and induce the consumer to use them; still, the main point is, the greater the number we get into use the better off we shall be. As to the best way of effecting their introduction, it would seem as though each must be governed by his own necessities and experience,

MR. HARBISON—What is your price for gas per thousand feet?

MR. GILBERT—Our average price, or the rate at which most of our consumption is supplied, is $1.70. We are located away up in the wooded district (Grand Rapids, Mich.), and are obliged to haul our coal by rail for close on to 600 miles.

MR. STARR—Are all classes of your supply registered on one meter?

MR. GILBERT—The consumption is all registered on one meter, whether used for illumination or for cooking. We had at one time quite a serious opposition developed in the introduction and use of gasoline stoves. Twenty years ago we began the sale of gas cooking apparatus; and during the first seven years our success was so great that 95 per cent. of our consumers used gas stoves. The stoves, however, were all of very small sizes, but were found very effective. When the larger stoves and ranges came out some two or three years ago, our people wanted to get them and willingly gave up the small affairs. We have now about 250 large stoves at work in our

town. It has been rather a misfortune to the gas interest that gas stoves have been so poorly arranged. They are made too deep and too short. You can only get one pie in an oven at a time; and people object to employing so much heat for such a small cooking operation. I understand that a gas stove is now being manufactured which has an oven 18 or 20 inches in length; this improvement is in the right direction, There is no trouble in constructing gas stoves so as to deal properly with the products of combustion. The injurious and noxious fumes may all be safely carried off by simple flue connections. I am in hopes that by next year our gas stoves will have been so improved in shape and size that they will be rendered really invaluable to the housekeeper. We have labored under great difficulties heretofore on account of the cramped oven. I have not been a thorough advocate of the gas stove until this year. As to renting or selling—I tell any man who asks about the gas stove that I will set one up in his house free of cost to him; then, if he does not like it, I will take it back. In one or two instances I have had to take them back; but it is indeed very seldom that I am asked to do so.

Upon conclusion of the discussion the Chairman called for the reading of the next paper on the list, and accordingly introduced Mr. Thomas D. Gilbert, Secretary and Treasurer of the Grand Rapids (Mich.) Gas Light Company, who read the following paper on the subject of

THE RELATION OF CAPITAL TO THE OUTPUT.

The proportion of capital to its product should always be intimately considered by those seeking investments. If, through mismanagement or circumstances beyond control, any enterprise absorbs more money than is necessary to the accomplishment of a given amount of work, the result will be either small dividends or the charging of a price for the product that will induce competition from others who may wish to engage in the same business, and who perhaps will accordingly be enabled to do so under more favorable auspices than did the pioneers.

Heretofore this question of a proper relative proportion between the amount invested in gas works and the output of gas, or product of the capital, does not seem to have received much consideration. The reason is obvious, and may be briefly stated thus: Outside a few seaboard cities that had already attained considerable prominence before gas came into use, the organization and early history of all our gas companies has been much the same. Given a thriving town of a few thousand inhabitants; a few energetic men, with perhaps limited means; an exclusive charter from the municipality, with the right to charge what now seems to have been a high price for gas; works of a very limited capacity, built without reference to possible future needs; a steady increase or demand for light, until enlargement became necessary; again, an insufficient investment, owing to want of means or lack of faith in the future, etc.; tearing down and building greater, and we have the history of most of the gas works in the country.

All managers of gas property understand perfectly well that, could they start anew, it would be easy, with present knowledge and experience, to renew their plant with a smaller investment than was possible under former methods. On this enhanced cost stockholders naturally expected their dividends; and so it has come about that, in most places, high prices have been maintained, the use of gas restricted, managers became unpopular, and the business, in public estimation, became a synonym for everything disreputable.

Protected by supposed exclusive rights, the business was a monopoly; and it cannot be denied that until quite recently there has been shown a great want of that progressive spirit on the part of gas managers which gives to all business its best results. Under these circumstances new methods and new lights came into existence. Competition, encouraged by stubborn adherence on the part of old companies to high prices, obtained a foothold in many places, and the owners of gas property were obliged to consider the question whether the capital represented by their stock was not excessive. There is but little invested capital that occupies so precarious a position as gas property at the present time, unless well managed.

The manufacture and distribution of gas is a business so peculiar in many of its characteristics as to be almost outside the domain of rules governing other enterprises. Capital once thus invested cannot be moved; and if not profitable, is lost forever. Competition is so deadly to it that it is impossible for rival companies to occupy the same streets without ruin to both, or a consolidation, with its attendant double investment, and cheap light rendered an impossibility.

How to avoid the evils of competition and an unnecessary investment of capital are questions that must be considered; for on them rests the value of all gas property. The exact amount of investment necessary or proper to produce one million cubic feet of gas is, of course, impossible to fix, owing to varying conditions of population, business, and cost of material. A densely populated district, with its usual proportion of large consumers of gas, should require a smaller proportionate investment than a sparsely settled territory, and hence be able to obtain gas cheaper; but it does not always work out in that way. The cost of many of our gas works has been enhanced by circumstances beyond control. In this country more than in any other we have periods of unusual development in all our cities. In the West we call it a "boom," and "booms" have usually been contemporaneous with times of great railroad development.

These abnormal conditions have usually made necessary large present investments intended to meet future increased demands for gas and the money placed at a time when iron and labor (factors which enter so largely into the cost of gas works) were unusually high. Have we a right to expect full dividends on capital invested under such circumstances? Undisturbed and exclusive possession of the territory occupied is essential to success in our business, and will be beneficial to the public, if we deal fairly with it; but we have no right to expect it, unless we are content with moderate dividends on a fair valuation of our property. The interests of all who own gas property are so interwoven that what benefits or injures one benefits or injures all; and this is my only apology for calling the attention of the Association at this time to a ques-

tion which is of more essential importance than any other connected with our business. If a company, favorably situated, persists in maintaining prices that seem excessive, for the purpose of paying dividends on excessive capital, it may be sure that rivals, attracted by a seeming opportunity for good investments, will, sooner or later, obtain a foothold, with the usual result of gas sold without profit, until both parties tire of the foolish contest, and "pool their issues." Then the public pays a price for light that will earn and pay dividends on the double investment; and a just relative proportion between the capital and the output rendered forever impossible. During the time that rival companies are furnishing gas at, or below, cost, their pernicious example is quoted as proof that prices elsewhere are excessive; and so it happens that this senseless rivalry works great injury to those who are earnestly striving to keep down their investments with a view to furnishing light at the lowest price consistent with reasonable dividends.

You will notice that I have not undertaken to say anything in this paper about what my own ideas are on the subject, because it is impossible to establish a rule which will be fair in all localities. I merely state in general terms what the policy of my company has been. Our city is not a very large one; we have only about 42,000 inhabitants; and we are now experiencing decided symptoms of the electric lighting craze. For many years we have been selling gas at much cheaper rates than those obtained in most of the large cities in our country. Cities like Detroit, Indianapolis, Chicago and New York have been charging from 20 to 25 per cent. more for gas than we have been charging. We have been satisfied with our dividends, and have been moderately successful. We found that our capital was increasing out of proportion to our output, for the very reason that we were compelled to rebuild when material was high. We have laid pipe for our street mains that cost us $75 per ton; and we also have pipe that cost us but $30 per ton. We were brought face to face with the question of how much of that cost we ought to charge up to construction. We have during the last six years adopted the policy of charging everything to expense that pertains to the enlargement and

extension of our works, and give our stockholders the benefit of the rest of it. One result of this has been that we are now fairly successful. The people have been satisfied with the price of gas; and there has been no trouble as yet with competition. They may come "nosing" around us by-and-by, but there is not much temptation for the wreckers in view of the price at which we are selling gas. We think, on the whole, the policy we have pursued has been the better one. Of course, in the large cities they have their investments made; they also have their combinations, and they have things so arranged that what would apply to most of us would not apply to any of them. I take it, from what I have been able to hear and learn, that most of us here represent companies in the smaller cities. We have heard nothing said from the larger cities. I think that our interests are identical, and are all in the direction that I have taken the liberty to point out in the paper, which I submit to you for what it is worth.

On motion of Mr. Helme a vote of thanks was tendered to Mr. Gilbert.

DISCUSSION.

MR. WILLIAM HELME—What is your capital and your output per annum?

MR. GILBERT—Of course there are things connected with all gas companies that the owners do not care to publish; but I shall be very happy, in any private conversation with the gentleman, to give him any information of that kind desired.

MR. STARR—What is the price of your gas?

MR. GILBERT—We have three classes of customers: Those who consume 5,000 feet per month are charged at the rate of $1.60; those who use between 1,000 and 5,000 feet pay $1.80; and consumers of a lesser quantity than 1,000 cubic feet in thirty days pay at the rate of $2 per thousand. We are of the opinion that our schedule is a low one. Mr. Harbison calls particular attention to the fact that all classes of his consumers are supplied at one price. Of course, he does his business in the manner deemed best by himself; yet it seems to me that

the practice is not consistent with the general law of trade You can always buy 100 yards of any material at a lesser figure than if you purchased but one yard; and it is perfectly proper that such should be the case. It is no more troublesome to take the register of a meter that has passed 10,000 feet in a week than it is to take the one that has passed but 100 feet; indeed, I never yet could see any justice in putting an all-round price upon the gas sold. The increase in our business over that of a year ago, owing to the reduction in price and on account of the more general introduction of gas stoves and engines, has been so great that I can see the way clear to another considerable decrease in price in the very near future. There has been an advance of 20 per cent. in our output during the last year.

MR. HELME—At what figure were you selling gas on the 1st of October, in year 1883?

MR. GILBERT—At an average figure of $2 per thousand cubic feet.

MR. HELME—What is your output now?

MR. GILBERT—The annual output now is 50,000,000 cubic feet.

MR. HARBISON—How many miles of mains have you?

MR. GILBERT—About 24 miles.

MR. HELME—If Mr. Gilbert has a capital of half a million dollars, he has $10 invested for every thousand cubic feet of output for the year. I presume that his capital is very much less than that; and I do not doubt that his establishment is in excellent financial condition.

MR. GILBERT—I will tell the gentleman that I consider an investment of over $5,000 to a million feet of output too large.

MR. HELME—Any man who has stock in a gas company which has only $5,000 invested for each million feet of output per year is in a very good condition. It is almost impossible to avoid using more money than that in building gas works, even at the present time. Ours is a very peculiar business.

What would be a very good rule in any other business does not always work out well in this. In thriving towns it is necessary to lay out money year by year in main extensions. Nine-tenths of your stockholders are not found in a proper financial condition when a sudden call is made upon them to contribute the capital necessary for an extension of the mains. What is the result? It is what every Californian understands by the words "freezing out." Those who cannot respond are frozen out; and this is not fair. There may be a few who are able and willing to respond; but the poorer ones will find themselves out in the cold. And yet, if you attempt to keep down to $5,000 of capital invested to each million cubic feet of output, you will soon be in need of money to extend your mains; and if the extensions are not made you will have rather a lively time in quieting the demands made upon you. Every time you meet a resident of one of your suburban districts the first question will be, "When are you going to extend the gas mains out to my house?" After one or two oral applications of that nature are made from several residents of a particular district, and when it is found that the gas company is not acting quickly enough to suit the views of the complainants, why, the malcontents at next election elect a Councilman, perhaps, who will annoy you very much. In such suburban main extensions you are often required to spend thousands of dollars on which you get but sparse returns. If you measure in all cases the amount you must expend by the amount of business you get, the investment will sometimes amount to $50 on a thousand feet. Under those circumstances what would you do? There are a good many here who would like to know from Mr. Gilbert just how he would solve that problem.

Mr. Harbison—I think Mr. Gilbert has answered it by the statement that he charges a portion of his consumers $1.60 to $1.80 per thousand, while the remainder pay $2. Those who are paying him $1.80 and $2 are contributing the means, in the excess of price charged over their fellows, for making these enlargements. He charges the expense to construction account, and gives the stockholders what is left; and this, ac-

cording to his statement, they seem to be perfectly satisfied with. By this scheme the poorer people of Grand Rapids are extending his works for him, and are doing so for the benefit of the rich. My practice is in accordance with the example set us a great many years ago, in paying the laborer who wrought all day at the same rate as the one who wrought but an hour; and the one who wrought an hour, at the same rate as the one who wrought all day—putting them all on the same footing. That is precisely the sort of golden rule that we are following. We make no distinction, but treat everybody alike, and try to gain the goodwill and confidence of all. In that way you increase your business so largely (and by bringing the price down low to begin with) that you have no difficulty in bringing the pro rata of percentage of the amount invested in proportion to your output; and you thus accomplish it in a way much more satisfactory to the people, and also to your own conscience. You can thus secure a low rate of investment in proportion to the amount of gas sent out.

MR. GILBERT—This discussion has taken somewhat of the form of an arraignment; and I desire to say this much in reply: Our very smallest consumers are furnished with gas at $2. Mr. Harbison speaks of that rate as being excessive; but I hardly think that he meant to use that term in an offensive sense.

MR. HARBISON—Not at all.

MR. GILBERT—Even our smallest consumers in Grand Rapids have had gas, for the last year or two, at a less price than that paid by the large consumers in a great many of our chief cities; and so we have no cause for conscientious trouble about it. We feel, indeed, as though we had been working for the good of all of them. If this discussion will only bring the gas fraternity to consider the question whether they will not put down prices, and get along with less capital, before they tempt competition and ruin their property, it will not have been in vain. That is the real problem before us. You cannot afford to invite competition. Of course, there may be differences of opinion about the policy of having varying

schedules of prices; but it has been a good rule in all other houses of business to make such differential rates, and to our people the arrangement has been, and is, perfectly satisfactory. Nobody complains. The man who lives on the outskirts, and pays $2 per thousand, is perfectly satisfied, and would almost (because we have run the pipe to him) be satisfied at any price. My friend Helme inquires how we can extend our mains without calling on the stockholders for more capital, and thus perhaps freeze out somebody who cannot respond. It is because, as I have already stated, if we have accumulated a surplus, (no matter how small it may be) beyond what we consider a fair dividend, we invest that surplus right into the operation of main extension. Perhaps we could lay by enough to add three or four miles of main to our system, possibly we could add but one mile in the twelvemonth; but we are all the time doing something in that direction, and always in those districts where the action will be most beneficial to us. We certainly have a good deal of pipe which is not productive; but the people living in those neighborhoods are generally folks who do business down town, and are consequently using gas in their stores and shops. At any rate, I know the plan works harmoniously with us.

MR. W. H. PEARSON—What do you consider a decent dividend?

MR. GILBERT—That depends upon what the people have been accustomed to receiving.

MR. THOS. BUTTERWORTH—Are the parties who originally owned and built the Grand Rapids works also at this date interested in the management?

MR. GILBERT—Yes, sir.

MR. HELME—What are Mr. Gilbert's dividends? Let us hear that.

MR. GREENOUGH—I want to say that I am very glad Mr. Gilbert has introduced this subject. Mr. Gilbert may possibly look upon himself as a man who has been arraigned; but I want him to understand that there are a good many men in the

gas fraternity who are backing him. It is a principle which has been active in the guidance of a good many gas companies. I think it is wrong to load up any sort of stock with all the water it can carry; and if the plan of the stock jobber is brought up in this meeting, it ought to receive the condemnation of the Association. It is a matter which has not in this country received the attention that it deserves, although it is a question that is gone into pretty carefully on the other side of the water. One of the most careful figurers in the gas profession a few years ago read a paper on the relation of capital to output, and in it he took the ground that any company with over £5 capital for every ton of coal carbonized, had got too much money invested. Putting that into our money it means that you must earn 25 cents per 1,000 feet of gas sold, in order to pay a ten per cent. dividend. The old English figure is one shilling for gas, one shilling for distribution, and one shilling for interest; but we cannot do that on this side of the water; although the company with which I am connected have, by pursuing the policy which Mr. Gilbert has followed in his company, brought themselves into very nearly that position. We have not got to earn much more than 25 cents in order to pay our dividend, and we are consequently in first-class fighting condition. I have no doubt that you can to-day put up works in all the large cities which as dividend payers will not require over 50 cents earned per thousand feet of gas consumed. When people allow themselves to put more stock than that into gas works, I think they are loading the business with more capital than it is intended for. I think this Association desires to endorse the views of Mr. Gilbert in giving an expression of their opinion on this matter. (Applause.)

Mr. Eugene Vanderpool—I have to differ with my friend Greenough with reference to the amount of capital invested in gas works in England in proportion to the number of thousand feet of gas distributed per annum, and to state that one shilling will not, in all cases, pay ten per cent. interest on the capital. I have some memoranda here which I took from Mr.

Field's analysis of the accounts of the London gas companies, the suburban companies, and the provincial companies, both those owned by the cities and those owned by private corporations. I find that the capital, per thousand feet of gas sold per annum in London, is $3.22; of the suburban companies, $3.62; of the provincial companies owned by the cities, $3.52; and of the provincial companies owned by private corporations, $2.94. But the sales of gas there are much larger than with us, being in the city of London 5,580 per annum per head of population; in the large town, 4,238; and in the smaller towns, 2,500 to 2,800 cubic feet. I have the returns of a number of companies in this country, and find that the capital invested, per thousand feet of gas sold per annum, will run, in towns of from five to ten thousand inhabitants, at about $15; from 10,000 to 25,000, $8; from 25,000 to 50,000 inhabitants, $8; and from 50,000 to 100,000, $7; and from 100,000 and upwards, $6.25. The sales per head of population vary from 400 feet in the small towns, to 2,600 in the large cities.. We must remember that in this country materials and labor are from two to three times higher than in England.

MR. GREENOUGH—As I understand the gentleman's figures, he says that from a population of a hundred thousand up the investment averages about $6.25. You have to earn 62 cents in order to pay 10 per cent. dividend. I do not think that that invalidates my position at all. Mr. Livesey took the ground that those English companies had too much capital invested; that a good deal of the capital of the chartered companies was invested uselessly, and, to a certain extent, was thrown away. Those works could be replaced to-day at figures which would pay 25 per cent., beyond doubt. If the capitals of companies in this country be taken into account, I want the gentleman to remember how much capital has been put into most of our large cities which is uncalled for and unnecessary. In the city of New York to-day there is some $26,000,000 of capital invested owing to competing gas companies. Will the gentleman tell me that if new works were to be there built, $15,000,000 would not be ample to supply the needs of New

York's consumers? In Baltimore (Md.) they had $9\frac{1}{2}$ millions dollars invested before they took the new Equitable Company into the last arrangement; yet at Baltimore they do not sell as much gas as we do in Boston, with but one-quarter of their capital. In Chicago (Ills.) as in some other large cities, they have a large amount of stock which is not represented by plant, etc. If the gentleman wishes to take the actual cost of the work, or what the stock should really represent, he will not, in my judgment, find the sums figure out to $6.25.

MR. MCMILLIN—One of our noted gas financiers, General Andrew Hickenlooper, of Cincinnati, Ohio, some years ago investigated this question pretty thoroughly; and in his annual address to this Association he spoke of it. His estimate for the entire country was about $8 per thousand. In the preparation of a volume of "Economic Geology for Ohio," I had occasion to investigate the question pretty thoroughly; and I found that sum ($8) was just about what was invested per thousand in the State of Ohio. The figures agree pretty well with those presented by Mr. Vanderpool. From the Columbus (Ohio) works we sent out last year 120,000,000 feet, and this year we will probably send out 150,000,000. Our capital, up to the first of last April, was $400,000, but it has since been increased to $500,000.

MR. WOOD—I think possibly one of Mr. Gilbert's remarks has been either overlooked or forgotten. This is in regard to the assertion which enables him to pay out of expense account for the extension of mains, declare dividends, and sell gas at a low price. It may be accounted for in his case in this way, owing to low distribution charges. He has only 24 miles of mains for conveying an annual output of 50,000,000 feet; and I think that main mileage is very largely below the average of companies represented here. It seems that his town is very compactly built up, consequently his conduits do not extend for miles out into the country, as is the case with many of us. His cost of distribution, therefore, is brought down to a minimum, which fact enables him to do as he has told us.

MR. GILBERT—We have five or six miles of mains that do not pay 3 per cent. on the investment.

MR. HELME—What were you selling gas at last year?

MR. GILBERT—Two dollars per thousand on the average.

MR. GEO. B. NEAL—The hour fixed by the Committee of Arrangements for adjourning is six o'clock, and we have still the report of the Special Committee on the addresses of Past-Presidents Hickenlooper and Forstall to consider. While this discussion is very interesting, it seems to me that we shall not now have time to prolong it if we propose to adjourn at six o'clock. I would therefore suggest that we proceed to consider the report on the President's Address. I think we should not allow any discussion, however interesting, to crowd out the reception of the report mentioned.

THE PRESIDENT—If it be the pleasure of the Association we will now listen to the report of the Special Committee appointed to consider the suggestions embraced in the inaugural addresses of Past-Presidents Hickenlooper and Forstall.

In accordance with the President's request, Mr. Eugene Vanderpool, chairman of that Special Committee, presented and read the following report:

REPORT OF COMMITTEE ON ADDRESSES OF PAST PRESIDENTS.

To the Members of the American Gas Light Association—
Gentlemen: The Committee appointed by you to consider the recommendations contained in the annual addresses of Past-Presidents Hickenlooper and Forstall, would respectfully submit the following as a supplemental and final report:

1. It is the opinion of your Committee that it would be decidedly advantageous to the gas interests of the country if there was an organization properly officered and efficiently supported that would represent in a general way the gas interests of the country.

2. This organization could determine in an authoritative manner mooted questions of a technical character that now exist, or may hereafter arise, in our industry; and might also be instrumental in preventing the formation of so-called competing companies, and in obtaining legislation that would harmonize the interests of the consumers and the companies.

3. After much thought your Committee is convinced that a complete organization cannot be immediately effected; its growth will require time and experience. It is thought that the foundation of the organization may be already laid in the Associations that already exist in several of the States, having for their object the protection and advancement of their mutual interests. And it is hoped that at this meeting of the Association the members present representing companies interested in their State organizations will confer together and consider the expediency of taking prompt action in the direction suggested.

EUGENE VANDERPOOL,
THOMAS TURNER,
A. B. SLATER,
A. C. WOOD. } Committee.

THE PRESIDENT—If there is no objection the report of the Committee is received. What action will you take upon it?

MR. J. P. HARBISON—I move the report be adopted, and printed in the *Journal*, and that the Committee be discharged.

THE PRESIDENT—Are there any remarks to be made upon the motion of Mr. Harbison?

MR. E. MCMILLIN—It is unfortunate that the report was not presented at the beginning of the session, when we would have had sufficient time to digest it. It is now too late to discuss it properly.

MR. VANDERPOOL—I will state that some of the members of the Committee did not arrive here until last night, consequently we did not hold a meeting until to-day.

THE PRESIDENT—If there is nothing further to be said, I will put the question upon the adoption of Mr. Harbison's motion.

The motion was agreed to, and the President stated that routine business was in order.

VOTES OF THANKS.

MR. HARBISON—One year ago when the Committee on Nomination of Officers for the year now drawing to a close

made their report, and in it presented the name of William A. Stedman, of Newport, R. I., for the office of President of this Association, the members who were personally acquainted with that gentleman knew (when subsequently he was unanimously elected President of our organization) that the proceedings of the year would be conducted with at least as much thoroughness and earnestness as had been those of any previous period in our history; and some of us who knew him intimately felt that our sessions might exceed in value those that "had gone before." I believe, sir, it is the unanimous opinion of the members of this Association, that such pleasant anticipations have been more than fulfilled, and make bold to say that our Twelfth Annual Session stands at the top of the record. There has been a notable increase in our adherence to rules of order, a much greater attention bestowed upon the reading of the papers, and a more generous participation in the discussions than has been witnessed at any of our previous meetings. It affords me, then, very great pleasure to move that a hearty vote of thanks be extended to President Stedman for the most efficient, able and courteous manner in which he has discharged the duties of his office during this session. (Applause.)

The motion was seconded by Mr. Butterworth, put by the Secretary, and unanimously agreed to by a rising vote.

THE SECRETARY—Mr. President, it becomes my pleasant duty on behalf of the members of this Association to extend to you their heartfelt thanks for the very courteous and able manner in which you have presided over the affairs of the Association during the past year.

THE PRESIDENT—Gentlemen, I wish to acknowledge what seems to me to be in the nature of an extraordinary courtesy on your part, and to say to you how much I am gratified at this expression of your favor in making such graceful recognition of the manner in which I have filled the Chair. Brother Harbison always had a remarkably keen scent after the good qualities of his neighbors, and a very hearty appreciation of them; indeed I can assure you he is an extraordinarily good friend. I was not, however, aware that I had done anything

more than my simple duty, and a twelvemonth ago, when I accepted the office, I promised you that I would do the best I could. Necessarily the great bulk of the labor in preparing for the meeting, in arousing and maintaining the necessary interest among so many widely-scattered members, devolves very largely upon the Secretary of the Association; and I feel that it would be wrong for me to take to myself any large measure of the praise due (if there be any due) for the success of the meeting; and I say so because the gentleman beside me, as your Secretary, has done such hearty, faithful, assiduous and untiring work, that he has entirely surpassed me in my efforts to make this meeting a success. Perhaps it may be an unparliamentary thing, nevertheless I am going to ask you to accord to the Secretary a hearty vote of thanks for his efficient labors on our behalf during the past year, and to that expression of your recognition I desire to add the tribute of my sincere admiration for his work and its result. Since I was in a position to know the amount of labor involved, and of the earnestness and fidelity with which every part of that labor was accepted and performed, and knowing what he has done, and how faithful to your interests he has been, I will ask you to pass a very hearty vote of thanks for the fidelity with which he has discharged all the duties of his office during the past year.

Mr. William Helme—I take great pleasure in seconding the motion of President Stedman.

Mr. Harbison—I desire to add a single word to what our President has said with regard to our worthy Secretary. I had a few minutes' conversation with a member of the Finance Committee right after the Committee had made their report, and after the Treasurer's report had been adopted by the Association. This gentleman informed me that in his opinion the Treasurer's Account, for 1884, had been well kept. I think the complimentary terms which this member of the Finance Committee used in regard to the way in which the books had been kept during the past year should be known to the members of the Association, and that it is due to our Trea-

surer that a public recognition of his services should be made. The report which was read yesterday was exceedingly creditable in respect of the manner in which the accounts had been kept. It was a very clear and comprehensive detailed statement of the financial condition of the Association at the present time, as well as a record of the business of the past year. I am heartily in accord with the motion.

THE PRESIDENT—If there is nothing further to be said, I will put the motion: That this Association accords its hearty vote of thanks in testimony of its appreciation of the signal ability with which the Secretary has conducted the duties of his office during the past year. I think that we can compliment him by a rising vote.

The resolution was unanimously adopted in the manner indicated by the Chairman.

THE SECRETARY—Gentlemen, I am very much pleased by this kindly expression of your approval, and I can only say to all the members of the Association, and particularly so to the President, that my heartfelt thanks are due.

MR. S. G. STINESS—Before this Association adjourns it owes it to itself to make some recognition of the very assiduous labors of a most indefatigable Committee of Arrangements, who have so well provided for our comfort and entertainment during our sessions in the city of Washington. I move that the thanks of the Association be extended to the Committee for their attention to our comfort.

The motion, seconded by Mr. Starr, was unanimously adopted.

MR. WILLIAM HELME—It is a great source of satisfaction to be able to feel that the Committee of Arrangements are entitled to an expression of approbation for what they have done. As you all know, Mr. Geo. A. McIlhenny is not very well able to get about, and it therefore devolved upon me to do what he would have done had he been in good health. We have done our best, in connection with the Secretary, to make everything satisfactory in so arranging matters that you may have had a pleasant time, and carry with you to your homes a pleasant

memory of our meeting in Washington. I hope we may all meet next year with General Andrew Hickenlooper, in Cincinnati, Ohio, where he has promised to show us his new and handsome works; and I have no doubt that his and our expectations in respect to them will be in every way realized.

The Association then adjourned *sine die.*

In Memoriam.

"To-morrow we shall meet once more;
'Tis but the night that parts us here."

GEO. WARREN DRESSER,
Editor American Gas Light Journal, New York.
DIED MAY 27, 1883.

MILES W. CAUGHEY,
Secretary Erie Gas Company, Erie, Pa.
DIED SEPT. 20, 1883.

WILMER G. CARTWRIGHT, M.E.,
Of Stevens Institute of Technology, Hoboken, N. .J
DIED FEB. 23, 1884.

I. HERZOG,
Engineer Metropolitan Gas Light Company, New York City,
DIED OCT. 23, 1884.

M. H. JONES,
President Easton Gas Co., Easton, Pa.,
DIED JUNE 1, 1883.

EDWIN KEITH,
Superintendent Taunton Gas Light Co., Taunton, Mass.
DIED APRIL 30, 1882.

JAS. D. MERRIMAN,
Manager Vare Cruz Gas Co., Vera Cruz, Mexico.
DIED JUNE 10, 1883.

W. H. PRICE,
Pres't Cleveland Gas Light and Coke Co., Cleveland, Ohio.
DIED JUNE 8, 1883.

A. W. RICHARDSON,
President North Adams Gas Co., North Adams, Mass.
DIED SEPT. 4, 1883.

OBITUARY.

GEORGE WARREN DRESSER,

The long-protracted and agonizing illness of Major G. Warren Dresser culminated in his death at the Reitz cottage, Newport, Rhode Island, on the afternoon of Sunday, May 27th, 1883. It is with no ordinary feelings of sorrow and regret that we place upon record a sketch of the life and work of our departed friend, and know that so much of the record as pertains to Major Dresser's career in connection with the United States military service must necessarily be very imperfect, from the fact that he never cared to discuss events in which he bore a prominent and distinguished part.

Major Dresser was born in Abington, Connecticut, on the 15th day of September, 1837. In his early boyhood he showed a decided liking for military life, and was placed in the Worcester (Mass.) High School, and subsequently transferred to the Andover (Mass.) Academy, from which institution he graduated in the summer of 1856. He passed the preliminary examination, and entered the West Point Military Academy in July of the same year. During the course of his studies at West Point he displayed great aptitude for mathematics, and won the unqualified approval of his superiors and tutors, and gained the thorough and lasting friendship of his associates and classmates. He graduated with the May class of 1861, and entered upon his military career when the Nation had manifest and urgent need of the services of just such clear-headed, stout-hearted men as the young cadet and his brother comrades were. He was commissioned Second Lieutenant of the Fourth United States Artillery, and went into active service on the sixth of May, 1861. During the months of May and June of that year he was detailed to assist in the drilling of the recruits joining the service at Washington, D. C. He entered the Manassas campaign as First Lieutenant, and took

active part in the famous battle of Bull Run, and in the subsequent defense of the city of Washington, D. C. He entered upon the Virginia Peninsular campaign in 1862, and was assigned to engineer duty at the siege of Yorktown ; at this period he was Acting Ordnance Officer of the Third Army Corps, which position he held for the space of about two months. From September, 1862, until August, 1863, he was detailed as Assistant Instructor of Artillery Tactics at West Point. During the remainder of 1863 he was assigned to engineer duty, and the command of his company, the Fourth Artillery, at Chattanooga, Tenn. While on duty at this point an incident occured which will serve to illustrate the courage and skill of the young artilleryman—

The point at which the Chattanooga division was concentrated, at this particular time, was situated some 86 miles from the base of supplies. The roads were very bad, and the surrounding country swarmed with detached bands of Confederate guerillas, who paid particular attention to the harassing and destruction of the trains destined to convey supplies to the Federal soldiers. The marauders had been very successful in their efforts to intercept the supply trains, and the Federal troops suffered much hardship in consequence. On the other end of the line, some nine miles distant, the Confederates were in possession of a river, on the south bank of which they had a strongly intrenched redoubt, garrisoned by a large force of picked men. General Grant, who had command of the Union forces at this point at the time, decided that the only thing to do was to bridge the river, and, if possible, drive the enemy from shelter. General W. F. Smith, well known as "Baldy," was summoned by General Grant, and ordered to undertake the perilous task. Gen. Smith selected the subject of this memoir to take charge and direct the operations of building the pontoon bridge, and to lead the assault. The young Lieutenant, in the face of a most galling fire from the redoubt on the opposite side of the river bank, successfully built the bridge, and in the subsequent charge routed the Confederates, and the future supplies of the Chattanooga division of the Federal army were assured.

He was appointed Inspector of the Fifth Army Corps in July, 1864, retaining the position until March, 1865; and during the ensuing four months was on detached service, on the staff of General "Baldy" Smith, in New Orleans, and New York city. He was brevetted Captain in August, 1864, for gallant services on the Weldon (Va.) Railroad, and made a regularly commissioned Major, March, 1865, in recognition of his gallant and meritorious services on the field during the war of the rebellion, resigning his commission on March 13, 1865.

Upon severing his connection with the United States Military Service, Major Dresser devoted his attention to the practice of the profession of civil engineering, and from 1866 to 1868 acted in the capacity of assistant engineer on the govern-works in Narragansett Bay. While acting in this capacity he made the examinations and surveys for the location of the Block Island Breakwater, and also had charge of the engineering details at Fort Adams, Newport, R. I. In 1869 he was resident engineer in charge of the Portchester Railroad. In 1870 he surveyed, located, and built the Wickford (R. I.) Railroad. From 1870 to 1873 he was engineer in charge of the extensive alterations made on the Croton Aqueduct, from 92d to 113th street, in this city, Mr. E. H. Tracy being chief-engineer of the Croton Aqueduct department. This work was one of great magnitude, and the manner of its construction has been thoroughly shown in the work it has done. Upon the completion of this structure he was engaged in various matters as consulting engineer, and his advice on many engineering matters, both large and small, was constantly solicited. In October, 1875, Major Dresser assumed the editorial control of the *American Gas Light Journal*, and continued uninterruptedly in that position to the day of his death.

On October 21st, 1875, Major Dresser was elected an honorary member of our Association, at its third annual meeting, held at Masonic Temple, in New York city; and no other man will be more missed from the annual gatherings of this body. December 1st, 1875, witnessed the formation of the Society of Gas Lighting, and at the first annual meeting the Major was

chosen secretary, and continued to perform the duties of that office to the time of his death. He was elected an active member of the American Society of Civil Engineers on July 5th, 1876, and was made a director of the same society in the year 1882. In the doings of this influential and powerful body of intelligent and aggressive men he was always prominent. He was elected a member of the Vestry of Trinity Church, New York city, on April 3d, 1877, representing St. John's Chapel in that body, and held the same position each successive year.

Major Dresser visited Europe on three occasions. His first visit (1878) was made in the capacity of the representative of the gas lighting interest of the United States, to investigate and report upon the status of the electric light. It will be remembered that the "arc" system of lighting had received great impetus from the introduction of the Jablochkoff candle, and that the world of artificial illumination was all agog over the surprising statements made by the latest projectors of the old-new system. The glamour which surrounded the Avenue de l'Opera, in Paris, did not blind the clear perception of the Major to the defects, high cost, and inequality of the system; and the report which he made upon the subject, published shortly after his return, has since been amply verified.

The second visit (1881) was made in connection with the introduction of the Ross stoking machinery to the notice of the European gas fraternity. It was at this time that he was elected an honorary member of the British Association of Gas Managers (now the Gas Institute), and also made an honorary member of the French Association of Gas Engineers.

The third and last visit (1882) was necessitated by the failing health of his accomplished and estimable wife, to whom he was united in marriage at Calvary Church, New York city, on April 21st, 1863. Mrs. Dresser's maiden name was Susan Fish Le Roy, and was a daughter of Daniel Le Roy, an old and respected resident of this city. The tender object of his third visit to Europe failed of success, for Mrs. Dresser did not rally from the wasting disease which prostrated her, and he himself there first experienced the symptoms of the trouble

which laid such vigorous and fatal siege to his robust frame. Mrs. Dresser passed away painlessly and peacefully in the first week of April of 1883, and the faithful partner of her happy, tranquil wedded life was not long separated from her.

As stated previously, he died at Newport, R. I., on the 27th of May, 1883, and was buried from Trinity Church in that city on May 30th, the Rev. Geo. J. Magill officiating. The pallbearers were Messrs. C. V. Smith and Albert M. Smith, of the Manhattan Gas Light Company, of this city; Mr. M. S. Greenough, of the Boston Gas Light Company, Boston, Mass.; Mr. E. A. Crocker; Messrs. H. A. Bently and Captain Judson, with whom he was associated in the engineer corps; Captain Morris, and Major Throckmorton, of the regular army, and stationed at Fort Adams, as also Captain Churchill and Mr. W. D. King. The gathering of the gas fraternity at the funeral was large and representative, called together as they were to pay the last sad offices of respect to one who, though now cold in death, had been very intimately associated with them for a number of years.

IN MEMORIAM.

"Soldier, sleep; thy warfare o'er—"

The necessarily brief, and somewhat imperfect, sketch which we have given above of the military and civil career of our departed friend will serve to show the energy of his character, and the vitality and variety of his talents. The cold type may easily be made to tell the story of the public actions of his life, but how wretchedly they fail when asked to chronicle the record of his inner self. Can they bring back to mind his hearty presence, the warm grip of his friendly hand, the cheering effect of his wise counsel? Only one answer comes back to these mournful questions—and that is the negative of silence. To those who were acquainted with the full knowledge of Major Dresser's sufferings during the last seven weary months, the tidings of the final ending brought with them thankfulness that his martydom was over. It is simply impossible to describe his fortitude and courage during the progress

of the disease from which he suffered—let it suffice to say that the same spirit which animated the breast of the young artilleryman at Chattanooga in 1863 survived with him to the last, and upheld him to the close.

It was singularly fitting and appropriate that the last sad rites of sepulture should be held on the day set apart by the country to revive in the hearts of its citizens the memories of those brave men who gave up their lives to secure its greatness; and in perfect unison and accord with the memories so evoked were the thoughts of those who assisted in the services which were celebrated in the chapel where, with his family, he had so frequently been a devout attendant. And while the earth may enshroud him in the gloom of the grave, there will still always remain with those who knew him best and loved him most the consolation that while with them in this life, the paths which he trod were those of the brave soldier, the scholarly engineer, the loving husband, kind father and true gentleman.

MILES W. CAUGHEY.

Miles W. Caughey was born at Mill Creek, near Erie July 7th, 1812. He was of Scotch-Irish descent, and was the oldest but one of his father's family. After following the business of contractor during the early part of his business career, in 1865 he was called to the Secretaryship of the Erie Gas Company. Mr. Caughey continued to fill this position, with credit to himself and profit to his employers, till the time of his death, September 20th, 1883; during this period the business of the Company greatly increased, till in 1882 it was considered necessary to commence the erection of a new works, but Mr. Caughey did not live to see the plant completed.

WILMER G. CARTWRIGHT.

Wilmer G. Cartwright, the only son of William Cartwright, of the Oswego (N. Y.) Gas Light Company, was born

near Philadelphia, April 18th, 1856. His father removed to Oswego, New York, during 1859, and in this town the son received his early education. He passed through the public schools and graduated with credit from the High School. In early life the subject of our sketch showed a great aptness and fondness for mechanics, and a searching spirit for scientific investigation; when a boy, and when many youths were interested in amateur printing, he procured a press and type and published for a couple of years a small paper. From 1876 to 1878 Wilmer Cartwright was the Chief Assistant of his father at the Oswego Gas Works; taking particular pleasure in the laboratory and experimental work. In 1878 he entered the Stevens Institute of Technology, receiving the Priestly Prize for proficiency in chemistry, in his third year, and graduated in 1882. He continued at the Institute as assistant to Professor Thurston to the time of his death, February 23d, 1884, having charge of the mechanical laboratory. He joined the American Gas Light Association in October, 1883, only a few months before his death. At the time of his death he was engaged in making some experiments on the gas engine.

By the death of Wilmer Cartwright, cut off when his prospects seemed so bright and cheering, the gas profession has lost one, who, by virtue of his taste for scientific studies, and his practical experience in the conduct of a gas works, bade fair to become a shining light among his confreres; and a father has lost a son in whom all his earthly hopes were stayed.

IGNATIUS HERZOG.

Ignatius Herzog was born about 1840 in a small mining village in Upper Silesia, Germany. Although the son of plain folks he received a fair education; on the completion of his studies he engaged in the gas business, and was connected in various capacities, at different times, with several small gas works in Prussia. About 1864 he took a contract to build a small gas works; but the venture failed, and he was compelled to seek his fortune in America. He arrived here in 1865; and

for some years he struggled hard against adverse circumstances to make a living. In 1867 he became connected with the Metropolitan Gas Company, of New York City, as jobber in the meter department. By close attention to business, by his perseverance and intelligence, he rose to positions of trust: Night Clerk, Superintendent of Lamp Department, and Assistant Engineer, were the subordinate positions he occupied, till in July, 1872, he was appointed Acting Engineer; and in February, 1875, he was made Engineer. During his occupancy of this position the maximum daily outsend rose from 2,500,000 to 4,000,000 cubic feet. Mr. Herzog's health had been poor since 1873, and of late years he had been compelled to seek relaxation from business cares at short intervals. A trip to Europe in 1881 gave him only temporary relief, and in June, 1883, he had to retire from work entirely. His sickness culminated in softening of the brain, and he died of this disease, October 23d, 1884. His untiring zeal and energy, coupled with his fidelity to business interests, will always be remembered by those who came in contact with him during his professional career.

MATTHEW HALE JONES.

MATTHEW HALE JONES, the youngest child of Amasa and Elizabeth Huntington Jones, was born at Coventry, Connecticut, September 11th, 1811, and died at Easton, Pennsylvania, June 1st, 1883, in his seventy-second year.

While a mere lad his father changed his residence to Wilkes Barre, Pennsylvania.

Mr. Jones was graduated at Rutgers College, at New Brunswick in the State of New Jersey, in 1830; and very soon afterwards settled at Easton, living there continuously until his death.

He was a widely known and distinguished lawyer, engaged in practice for nearly fifty years, having been admitted at Easton in 1833. When he died, he had been President of the Easton Gas Company from its organization in May, 1851, in continuous service more than thirty-two years, and one of the

oldest Presidents in the country, probably the oldest; in length of uninterrupted service.

His personal characteristics were veiy marked, exhibiting executive ability and force of character to a high degree ; his mind powerful, and memory prodigious, his habits were scholarly, and reading extensive ; and he was deservedly esteemed, for the many rare and admirable traits he displayed. Although his life was an active one, his vigor enabled him to discharge the various duties cast upon him, until a few months before his death.

EDWIN KEITH.

EDWIN KEITH was born in Bridgewater, Mass., August 3d, 1804, and died in Taunton, Mass., April 30th, 1882.

He was of a modest, retiring disposition, so much so, that he never became acquainted with very many of his associates of the gas fraternity. Being of a mechanical turn of mind he was sought for by the contractor who built the Taunton Gas Works, and he took eharge of them, July 15th, 1855, remaining in control until his death. He made the undertaking a financial success from the start, showing marked ability in his management of the Company's affairs. He was of a very conservative nature, careful and discreet, never adopting or making a change without being fully satisfied of its utility and of the benefit to be derived from it, thereby meriting a well deserved success. Although death has removed a kind husband, and indulgent father, yet his family have the consolation that he left very few enemies, but hosts of friends who will sadly miss his friendly greetings and salutations, as they journey onward towards that home from which no traveler returns.

JAMES D. MERRIMAN.

JAMES D. MERRIMAN was born at Pictou, N. S., in 1847. After receiving his education he began life as a telegraph operator. In 1864 he joined his uncle Mr. Jas. Allen, in

South America. Mr. Allen was Manager of the Gas Works at Copiapo, and Valparaiso, and Mr. Merriman was his assistant from his arrival at South America until 1866. In the latter year the subject of our sketch returned to Scotland, and entered the firm of Messrs. Laidlaw to study engineering, this firm having the contract to build gas works at Harrington, Eng. Mr. Merriman was sent there to construct them, and later he erected works for the same firm at Caltanisetta, Sicily. During his residence there, Caltanisetta was swept by the Asiatic cholera. Mr. Merriman caught the dread disease and narrowly escaped death. He was ordered home by his physician, and arrived at Nova Scotia toward the end of 1867. He then went into business with his uncle at Halifax, while there he met with an accident, which after two years illness made necessary the amputation of one of his legs.

In January, 1871, he accepted the position of Manager of the Pictou Gas Works. In 1873 he sailed for England, while there he was offered the managership of several works, but none of them being just what he desired, he returned to Nova Scotia. In March, 1879, Mr. Merriman, with the aid of a friend, bought the Pictou Gas Works, and spent the next four years in managing and improving them. After putting these works in thorough order, he left a working manager in charge, and sailed to take charge of the works at Vera Cruz, Mexico, where he arrived May 20th, 1883; on June 10th, only three weeks after his arrival he died of yellow fever.

Mr. Merriman was a valued member of our Association, and though he was not able to attend all our meetings, he was enthusiastic in his support of the Association. When Mr. Merriman sailed for Mexico, it was his intention to return in the Fall, to attend our annual meeting, a striking illustration of the value he placed upon our Association. If he valued the friendships formed at our annual gathering, it is equally true that scores of the members valued his friendship. His death leaves a void which will be sadly felt by many of our members who admired him alike for his professional ability and his urbane disposition, and feel it a privilege to be considered his friends.

WILLIAM H. PRICE.

William H. Price, President of the Cleveland Gas-Light and Coke Company, died June 8th, 1883, at his residence, 1325 Euclid avenue, Cleveland, Ohio, after a long and exhausting illness from a complication of ailments, among which were typhoid fever and inflammatory rheumatism.

Mr. Price was well known to the citizens of Cleveland, and his great popularity was well deserved and bounded only by his circle of acquaintances. He was born in Freedom, Cataraugus County, New York, January 18th, 1818, and was therefore over sixty-five years old at the time of his death. When but a mere boy he was brought to Ohio, and received his education at the Grand River Institute, in Austinburg, Ashtabula County. On leaving school he turned his attention to law and studied with Judge Hitchcock, in Painesville. He was admitted to the bar and practised for a short time; but the failure of his health compelled him to abandon the profession, in which he was making good progress. He then turned his attention to mercantile pursuits, and carried on business for some time in Ashtabula County. In 1856 he removed to Cleveland, when the mercantile firm of Stillson, Leek and Price was formed; for ten years he continued a member of this firm, and then withdrew to turn his attention in other directions. In 1868 he was elected President of the Cleveland Gas-Light and Coke Company, holding that position until the time of his death. It is scarcely necessary to refer to the manner in which he looked after the interests under his charge by virtue of his office. He was untiring in his efforts to extend the usefulness and cheapen the cost of gas, and the numerous uses to which gas has been applied in Cleveland, and the continuous reductions in cost to the public testified to the success and value of his efforts.

Whilst a hard worker in business matters Mr. Price took an active interest in public affairs, although not a politician in the narrow sense of the term. In educational matters he was always strongly interested and had no small share—both as a member of the Board of Education and as a public spirited

private citizen—in laying the foundations broad and deep, and in building strong the superstructure of the public school system of Cleveland. Although for many years not officially identified with the management of the schools, he retained a keen interest in their fortunes to the last, as in his earlier years; he was strongly in favor of a sound, liberal, and practical training for children without needless extravagance, but without stinting necessary cost for a good article. For several years he was one of the Trustees of the Northern Ohio Lunatic Asylum, and was made President of the Board; at the time of his death he was President of the Board of Infirmary Trustees.

Mr. Price was one of the original founders of the American Gas Light Association, and at the initial meeting of the gentlemen who assembled in New York City on April 16th, 1873, for the purpose of organization he was one of the committee of six appointed to draft a constitution and by-laws. It will be remembered that the original designation of this body was "The Gas Light Association of the United States." When the body had permanently organized, Mr. Price was elected as second Vice-President; was re-elected to the same position in October, 1873; becoming first Vice-President in 1874, and continuing as such up to October, 1879, when he was elected to the presidential chair—succeeding General Charles Roome, of New York City, who had acted as President up to that date. He was re-elected to this position in 1880, and was succeeded in 1881, by General Hickenlooper, of Cincinnati.

The success which has attended the efforts of the American Gas Light Association is in a great part due to the zeal and watchfulness of Mr. Price, who was always untiring and active in his exertions in its behalf. He was a gentleman of broad culture, an eloquent speaker, a deep and original thinker, an uncommonly entertaining conversationalist, and a vigorous and terse writer. He was one of the foremost men in the gas fraternity of the country, and his opinions on matters relating to business were always given the attention and consideration which they so justly merited.

Mr. Price was a thoroughly public spirited man, and was admired and beloved by his fellow-citizens for his liberal and

energetic qualities, and in his death Cleveland lost one of its brightest men.

Mr. Price was married, in 1843, to Miss Martha Guild. She died in 1877, after twenty-four years of happy wedded life, leaving a son and daughter.

The funeral took place from his late residence, No. 1325 Euclid avenue, Cleveland, Ohio, on Tuesday, June 12, 1883, at 2:30 P. M., the pall bearers were: Messrs. J. H. Morley, D. P. Eels, F. A. Sterling, Charles Taft, O. J. Hodge, D. M. Marsh, and C. C. Baldwin. The interment was made in Lake View Cemetery. The most appropriate panegyric that can be spoken of our deceased friend and fellow-worker, will be to point to the nobility of his character and work, and of him it may be written, "He died, full of years and honors."

A. W. RICHARDSON.

Mr. A. W. Richardson was born at the old Richardson homestead, on the road from Adams to North Adams, Mass. Being one of a large family he commenced early in life to support himself, and after acting as clerk in different houses at Adams for several years, he launched out in the dry goods business on his own account. From the first Mr. Richardson was successful in his business undertakings, and in a few years was the principal owner of several mills.

In 1865 the works of the North Adams Gas Company were built. Mr. Richardson became interested in this enterprise from the start, and was President of the Company from a few years after its commencement to the time of his death.

Mr. Richardson died September 4th, 1883, his wife and five children survive him ; one of them Frank J. Richardson is the Manager of the North Adams Gas Company.

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THOMAS BUTTERWORTH,	ROCKFORD, ILLS.
MALCOLM S. GREENOUGH,	BOSTON, MASS.

SECRETARY AND TREASURER.

C. J. R. HUMPHREYS,	BERGEN POINT, N. J.

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WM. CARTWRIGHT,	OSWEGO, N. Y.
PETER T. BURTIS,	CHICAGO, ILLS.

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THEOBALD FORSTALL, WM. A. STEDMAN.

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THOMAS BUTTERWORTH,	ROCKFORD, ILLS.

SECRETARY AND TREASURER.

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FINANCE COMMITTEE.

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GEO. S. HOOKEY,	AUGUSTA, GA.
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EXECUTIVE COMMITTEE.

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T. TURNER,	CHARLESTON, S. C.
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R. R. DICKEY,	DAYTON, OHIO.

PAST PRESIDENTS.

CHAS. ROOME, W. H. PRICE, A. HICKENLOOPER,
THEOBALD FORSTALL.

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WILLIAM KING, Engineer Gas Company, Liverpool, England.
W. W. GREENOUGH, Treasurer and Agent Boston Gas Light Company, Boston, Mass.
General CHAS. ROOME, President Consolidated Gas Company, New York, N. Y.
Prof. HENRY MORTON, Ph. D., President Stevens Institute of Technology, Hoboken, N. J.

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Allmand, C. S.,	Norfolk, Va.
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Allen, Horatio P.,	New York, N. Y.
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Baxter, Robert,	Halifax, N. S.
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Forstall, Theobald,	Chicago, Ill.
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Fowler, John,	Philadelphia, Pa.
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Floyd, Henry E.,	New York, N. Y.
Floyd, Fred W.,	New York, N. Y.
Fullager, John,	Cincinnati, Ohio.
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Gardner, Jas., Jr.,	Pittsburgh, Pa.
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Gerould, Chas. L.,	Manchester, N. H.
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Hookey, Geo. S.,	Augusta, Ga.
Hopper, Thos. C.,	Philadelphia, Pa.
Hopper, Wm. H.,	Philadelphia, Pa.
Howard, Laclede J.,	St. Louis, Mo.
Humphreys, Wm.,	Dansville, N. Y.

Humphreys, Alex. C.,	Philadelphia, Pa.
Humphreys, C. J. R.,	Lawrence, Mass.
Huntington, P. W.,	Columbus, O.
Hyde, Gustavus A.,	Cleveland O.
Isbell, Chas. W..	New York, N. Y.
Jones, Edward,	So. Boston, Mass.
Jones, Edward C.,	So. Boston, Mass.
Jones, S. Lewis,	Philadelphia, Pa.
Judson, Chas. E.,	Chicago, Ill.
Kraft, George W.,	Philadelphia, Pa.
Kerr, John,	Kingston, Ontario.
Kingsbury, F. D.,	Corning, N. Y.
King. E. J.,	Jacksonville, Ill.
Knowles, Jno. H.,	Richmond, Va.
Kuehn, Jacob L ,	York, Pa.
Lamson, Chas. D.,	Boston, Mass.
Lane, Wm. M.,	Lancaster, Pa.
Langford, John T.,	Boston, Mass.
Leach, Henry B.,	Taunton, Mass.
Learned, E. C.,	New Britain, Conn.
Learned, Waldo A.,	Newton, Mass.
Leavitt, Hayward G.,	New York, N. Y.
Lindsley, Edward,	Cleveland, O.
Linton, I.,	Ravenna, O.
Linton, W. H.,	Ravenna, O.
Littlehales, T.,	Hamilton, Ontario.
Loomis, Burdett,	Hartford, Conn.
Lowe, L. P.,	Philadelphia, Pa.
Ludlam, Edwin,	Brooklyn, N. Y.
Lynn, J. T.,	Chattanooga, Tenn.
McCauley, L. G.,	West Chester, Pa.
Maurice, C. F.,	Sing Sing, N. Y.
Mayer, Frederick,	Baltimore, Md.
Merrick, Samuel V.,	Philadelphia, Pa.
Merrill, Hiram,	Janesville, Wis.
McElroy, John H.,	Pittsburg, Pa.
Merritt, Charles H.,	Danbury, Conn.
Merrifield, Paul S.,	New York, N. Y.
McMillen, Emerson,	Columbus, O.
McIlhenny, George A.,	Washington, D.C.
McIlhenny, John,	Philadelphia, Pa.
Miller, W. H.,	Columbus, O.
McDonald, Wm.,	Albany, N. Y.
Moore, David,	Salem. Mass.
Morris, Henry G.,	Philadelphia, Pa.
Moses, Geo. W.,	Chelsea, Mass.
Monks, Rich. J.,	Boston, Mass.
McDougall, John,	Hornellsville, N. Y.
McCullough, Edmund H.,	Philadelphia, Pa.
Murphy, Hugh,	Sing Sing, N. Y.
Nash, C. H.,	St. Joseph, Mo.
Neal, Geo B.,	Charlestown, Mass.
Nettleton, Charles,	New York, N. Y.
Nettleton, Charles H.,	Birmingham, Conn.
Newell, John W.,	New Brunswick, N. J.
Norton, A. M.,	Nashua, N. H.
O'Brien, Wm. Jno.	Philadelphia, Pa.
Odiorne, Fred. H.,	Boston, Mass.
Page, Geo. Shepard,	New York, N. Y.
Parkhust, J. G.,	Coldwater, Mich.
Parrett, Willard,	Bloomington, Ill.
Parrish, Wm.,	Seneca Falls, N. Y.
Pratt, John C.,	Boston, Mass.
Pearson, Wm. H.,	Toronto, Ontario.
Peebles, Phillip,	Quebec, Canada.
Perry, Albert D.,	Quincy, Mass.
Perkins, James D.,	New York, N. Y.
Printz, Eugene,	Zanesville, Ohio.
Prichard, Charles F.,	Lynn, Mass.
Prichitt, Samuel,	Nashville, Tenn.
Pishon, T. J.,	Roxbury, Mass.
Potter, E. W.,	Ashland, O.
Ramsdell, Geo. G.	Vincennes, Ind.
Rankin, Benj.,	Louisville, Ky.
Raynor, Chas. H.,	Adrian, Mich.
Reinmund, Henry J.,	Lancaster, O.
Richardson, Frank S.,	North Adams Mass.
Richardson, George,	Wilmington, Del.
Rice, E. S.,	Logansport, Ind.
Rider. George,	Norwich, N. Y.
Robinson, William L.,	Uniontown, Pa.
Rogers, James F.,	Jamaica Plain, Mass.
Rollins, J. H.,	Worcester, Mass.
Roots, D. T.,	Connersville, Ind.
Roots, F. M.,	Connersville, Ind.
Ross, A. Q.,	Cincinnati, O.
Rowland, T. F.,	Greenpoint, N. Y.
Rowland, T. F., Jr.,	Greenpoint, N. Y.
Sabbaton, F. A.,	Troy, N. Y.
Slater, A. B.,	Providence, R. I.
Slade, Jas.,	Yonkers, N. Y.
Smallwood, Jas. B.,	Baltimore, Md.
Smalley, Andrew A.,	Newark, N. J.
Stanley, Ira N.,	Brooklyn, N. Y.
Sprague. Chas. Hill,	Boston, Mass.
Spaulding, E. G.,	Buffalo, N. Y.
Spaulding, Chas. F.,	Brookline, Mass.
Starr, James M.,	Richmond, Ind.
Seaverns, F.,	New York, N. Y.
Smedberg, Jas. R.,	Lancaster, Pa.
Spear, John Q. A.,	Boston, Mass.
Sheldon, H. H.,	Pawtucket, R. I.
Stedman, Wm. A.,	Newport, R. I.
Stein, E.,	Philadelphia, Pa.
Spencer, R.,	Burlington, Iowa.
Sherman, F. C.,	New Haven. Conn.
Sterling, J. M.,	Monroe, Mich.
Smith, Chas. F.,	Fitchburg, Mass.
Smith, Marcus,	Wilkesbarre, Pa.
Smith, Robert A. C.,	New York, N. Y.
Smith, James H.,	Newark, Ohio.
Simpkin, Wm.,	Richmond, Va.
Stiness, Sam'l G.,	Pawtucket, R. I.
Sloane, T. O'Conner,	New York, N. Y.
Somerville, Jas.,	Indianapolis, Ind.
Taber, Robert B.,	New Bedford, Mass.
Tayler, Geo. H.,	Warren, Ohio.
Thomas, Jos. R.,	New York, N. Y.
Thompson, Francis,	Charlestown, Mass.
Townsend, S. S.,	New York, N. Y.
Tufts, Nathaniel,	Boston, Mass.
Turner, Thomas,	Charleston, S. C.
Van Benschoten, Chas. C.,	N. R'chelle, N. Y
Vanderpoel, Eugene,	Newark, N. J.
Walker, Jas. H., Sr.,	Rochester, N. Y.
Walker, Jas. H., Jr.,	Milwaukee, Wis.
Warmington, G. H.,	Cleveland, O.
Watkins, Elias T.,	Chicago, Ill.
Watson, Chas..	Camden, N. J.
Weber, Adam,	New York, N. Y.
Weber, Oscar B.,	New York, N. Y.
Wells. George Henry,	Nasheville, Tenn.
Willets, Chas. A.,	Flushing, N. Y.
Williams, James,	Johnstown, Pa.
Williams, W. L.,	Paterson, N. J.
White, Wm. Henry,	New York, N. Y.
White, C. A.,	Philadelphia, Pa.
White, T. F.,	Houston, Texas.
White, Ed. D.,	Brooklyn, N. Y.
Whitestone, Henry,	Louisville, Ky.
Whitney, S. W.,	Albany, N. Y.
Wood, Ed. L.,	Lewiston, Me.
Wood, Austin C..	Syracuse, N. Y.
Wood. Gideon,	New Bedford, Mass.
Wood, Walter,	Philadelphia, Pa.
Yorke, Eugene H.,	Eastport, Me.
Young, Robert,	Allegheny, Pa.
Young, John,	Pittsburgh, Pa.
Zollikoffer, Oscar,	New York, N. Y.

Honorary Members.. 6
Active Members..273

CONSTITUTION

OF THE

AMERICAN GAS LIGHT ASSOCIATION.

I. The name of this Association shall be THE AMERICAN GAS LIGHT ASSOCIATION, and its office shall be in the City of New York.

II. The objects of this Association shall be—the promotion and advancement of knowledge, scientific and practical, in all matters relating to the construction and management of gas works, and the manufacture, distribution and consumption of illuminating gas, to the end that its cost may be cheapened and its consumption increased.

2. The establishment and maintenance of a spirit of fraternity between the members of the Association, by social intercourse, and by friendly exchange of information and ideas on the before-mentioned subject matters.

3. The inducement and extension of more cordial and friendly relations between the manufacturers of illuminating gas and their patrons, based upon mutuality of interests and a recognition by both of the fact that each have rights which the other should respect.

III. The members of this Association shall consist of two classes, active members and honorary members.

IV. *To be eligible as an active member a person must be a president, vice-president, director, secretary, treasurer, engineer, consulting engineer, or superintendent of a gas company, or an individual manager of a gas works, or a person practically skilled in the construction and management of gas works, or engaged in industries relating thereto.*

V. Honorary members shall be gentlemen whose scientific or practical knowledge in matters relating to the gas industry, and whose efforts and interest in that behalf shall recommend them to the Association.

VI. Every applicant for active membership shall signify the same in writing to the secretary, addressed to the Association, indorsed by two active members.

VII. Honorary members shall be proposed to or by the Executive Committee, and notice thereof shall be given by the Secretary of the Association for its action. The election of applicants for active membership, and of persons proposed as honorary members, shall be by ballot, and each person shall receive two-thirds of the vote cast to be elected.

VIII. New members shall be formally introduced to the Association by the presiding officer after being elected, when they shall subscribe their names to the Constitution of the Association in a roll-book of the same, and they shall each, at the same time, receive a copy of the Constitution and By-Laws of the Association.

IX. If any applicant for membership or person proposed for membership, on being balloted for, be rejected, no notice shall be taken of the application, or action on the same, in the minutes.

X. The affairs of the Association shall be managed by an Executive Committee, subject to the control of the Association, by its actions in general meetings. The Executive Committee shall be composed of the officers of the Association for the time being, and the President or Acting President for the last preceding year. All questions in Executive Committee shall be decided by a majority vote, and five members shall be a quorum.

XI. The officers shall consist of a President, three Vice-Presidents, Treasurer and Secretary, six members of Executive Committee, and three members of the Finance Committee to

be elected annually by ballot. The President shall not be eligible for immediate re-election, and a change of at least one Vice-President, one member of the Finance Committee, and two members of the Executive Committee, must be made at each annual meeting.

XII. The officers of the Association shall assume office immediately after the close of the meeting at which they are elected; they shall hold meetings at the call of the President, or in his absence, at the call of the Vice-President, and make arrangements for carrying out the objects of the Association.

XIII. The President, or in his absence, one of the Vice-Presidents, shall preside at all meetings of the Association and Executive Committee at which he is present.

XIV. The duties of the Treasurer shall be to receive and safely keep all annual dues and funds of the Association; to keep correct accounts of the same, and pay all bills approved by the President or a member of the Finance Committee; and he shall make an annual report to be submitted to the Association.

XV. The duties of the Secretary shall be to take minutes of all proceedings of the Association, and of the Executive Committee, and enter them in proper books for the purpose. He shall conduct the correspondence of the Association; read minutes and notices of all the meetings, and also papers and communications, if the authors wish it, and perform whatever duties may be required in the Constitution and By-Laws appertaining to this department.

XVI. The Finance Committee shall meet on the day of each annual meeting of the Association, at least one hour before the opening of the meeting, to receive from the Treasurer a statement of his accounts, and audit the same. They shall hold such other meetings, from time to time, as the interests of the Association may require.

XVII. The annual meeting of the Association shall be held on the third Wednesday of October of each year at 10 o'clock

A. M., at such place as shall be designated by the Association at the previous annual meeting.

XVIII. At the annual meeting of the Association the order of business shall be :

1. The reading of the minutes of the last meeting.

2. The reading of applications, notices and reports for new membership.

3. The election and introduction of new members.

4. The address of the President.

5. The report of the Executive Committee on the management of the Association during the previous year.

6. The report of the Treasurer.

7. The report of the Finance Committee.

8. Reports of special Committees.

9. The election of officers.

10. The reading of papers, of which notice has been given to members by the Secretary, and discussions upon the same.

11. General business.

XIX. At other general meetings of the Association, the order of business shall be the same, except as to the 5th, 6th, 7th and 9th clauses.

XX. The Secretary shall send notices to all members of the Association at least fourteen days before each general meeting, mentioning the papers to be read, and any special business to be brought before the meeting.

XXI. The Executive Committee shall meet one hour before each general meeting of the Association, and on other occasions when the President shall deem it necessary ; of which special meetings reasonable notice shall be given, by special call in print or writing, specifying the business to be attended to.

XXII. All questions shall be decided by any convenient system of open voting, the presiding officer to have a second or casting vote when necessary.

XXIII. Questions of special nature shall be decided by ballot.

XXIV. Any member, with the concurrence of the presiding officer, may admit a friend to each meeting of the Association, but such person shall not take any part in the discussion unless permission to do so be given by the meeting.

XXV. All papers read at the meetings of the Association must relate to matters either directly or indirectly connected with the objects of the Association, and must be approved by the Executive Committee before being read.

XXVI. All papers, drawings or models submitted to the meeting of the Association shall be and remain the property of the authors.

XXVII. *Active* members shall pay an initiation fee of ten dollars, and the sum of five dollars annually thereafter, which shall be paid in advance.*

XXVIII. No member who shall be two years in arrears shall be entitled to vote, or to participate in the deliberations of the Association.

XXIX. Honorary members shall not be required to make any payments or contributions to the Association.

XXX. Any member may retire from membership by giving written notice to that effect to the Secretary, and the payment of all annual dues to that date, unless released from said payment by a vote of the Executive Committee. Any member whose dues shall remain unpaid for a term of three years, may be dropped from the roll of membership by a vote of the Executive Committee.

XXXI. Any member may compound for his annual payments by paying fifty dollars in one sum.

XXXII. A member may be expelled from the Association by a report and motion to that effect made by the Executive Committee, at any general meeting of the Association; the vote shall be by ballot, and shall require two-thirds of the vote cast for its adoption.

AMENDMENTS.

XXXIII. All propositions for adding to or altering any of the provisions of the foregoing Constitution, shall be laid bebore the Executive Committee, who may bring it before the next general meeting of the Association, if they think fit, and such Committee shall be bound to do so on the requisition in writing of any five members of the Association. Each member of the Association shall, upon request, be furnished by the Secretary with a copy of the Constitution and By-Laws of the Association, and also a list of the names and residences of the members.

REPORT OF THE TREASURER

OF THE

AMERICAN GAS LIGHT ASSOCIATION,

For the Year ending September 30, 1883.

WM. HENRY WHITE, *Treasurer*,

In account with THE AMERICAN GAS LIGHT ASSOCIATION.

1882.	Dr.	
October 1.	To Cash on hand	$1,350 23
18.	" Initiation Fees	290 00
Dec. 5.	" Sale Volume 4 of Proceedings	1 50
1883.		
Feb. 27.	" " " " "	1 50
July 1.	" Interest, Williamsburgh Savings Bank	27 76
	" " South Brooklyn " "	26 12
Oct. 1, 1882, to Sept. 30, 1883:		
	To Dues for year 1879	5 00
	" " " " 1880	25 00
	" " " " 1881	40 00
	" " " " 1882	170 00
	" " " " 1883	600 00
	" " " " 1884	60 00
		$2,597 11
1882.	Cr.	
October 13.	By Henry Crocker, printing	$4 50
	" Postage Stamps	3 50
23.	" Expenses of Secretary at Pittsburgh meeting	47 60
31.	" Printing President's Address	16 50
	" R. Macoy, stationery	4 00
	" Postage Stamps	5 00
1883.		
June 21.	" A. M. Callender & Co., publishing Vol. 5 of Proceedings	690 24
	" Printing	15 50
Aug. 10.	" Mailing Vol. 5	46 58

Aug. 15.	By	Printing	$4 50
	"	Postage	2 78
Sept. 5.	"	Telegrams	2 12
30.	"	Printing	3 25
	"	Postage	2 40
	"	W. H. White, salary	300 00
		Cash carried forward	1,448 64
			$2,597 11

The undersigned members of the Finance Committee have examined the accounts, books and cash of Wm. Henry White, Treasurer, for year ending Sept. 30, 1883, and find the same to be correct in every particular.

New York, Oct. 17, 1883.

A. B. SLATER,
JOHN ANDREW, } *Finance Committee.*
G. S. HOOKEY,

REPORT OF THE TREASURER

OF THE

AMERICAN GAS LIGHT ASSOCIATION

For the Year ending September 30, 1884.

C. J Russell Humphreys, *Treasurer*,

In account with The American Gas Light Association

1883.	Dr.	
October 18.	To Initiation Fees	$430 00
Oct. 1, 1883,	to Sept. 30, 1884:	
	To Dues for year 1881	15 00
	" " " " 1882	135 00
	" " " " 1883	295 00
	" " " " 1884	810 00
	" " " " 1885	35 00
1884.		
Sept. 30.	" South Brooklyn Savings Bank, interest	40 50
	" Williamsburgh Savings Bank, interest	24 30
	" Total Receipts	$1,784 80
	" Cash brought forward from years 1883-4	1,448 64
	Total of Debit Account	$3,233 44
1883.	Cr.	
October 17.	By P. L. Ryan, badges	50 00
	" D. Schneider, rent of hall	40 00
	" W. H. White, expenses New York meeting	79 55
	" Jas. R. Floyd, hospital expenses of David Douglass	100 00
	" A. M. Callender & Co., printing	42 50
	" Hy. Meigs, Jr., & Co., stationery	4 25
	" J. C. Cretin, engrossing resolutions	30 00

Sept.	11.	By A. M. Callender & Co., printing	$20 00
	13.	" Henry Meigs, Jr., & Co., stationery	12 75
	30.	" C. J. Russell Humphreys, salary	500 00
	30.	" Petty cash, postage, telegrams, and small items	90 91
		Total Expenditures	$969 96
		By Cash carried forward to years 1884-5	2,263 48
		Total of Credit Account	$3,233 44

STATEMENT OF CASH ON HAND SEPTEMBER 30, 1884

Deposit in South Brooklyn Savings Bank	$1,154 27
Deposit in Williamsburgh Savings Bank	1,039 30
Cash in Treasurer's hands	69 91
Total	$2,263 48
Due from members, including annual dues for 1885	1,770 00

The undersigned members of the Finance Committee have examined the accounts, books and cash of C. J. Russell Humphreys, Treasurer, for year ending September 30, 1884, and find the same to be correct in every particular.

Washington, Oct. 14, 1884.

JOHN ANDREW,
G. S. HOOKEY, } *Finance Committee*